INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR THIRD QUARTER 2000

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

DECEMBER 2000

U.S. DEPARTMENT OF ENERGY

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AMS	air monitoring station
amsl	above mean sea level
AWWT	Advanced Wastewater Treatment Facility
BRSR	Baseline Remedial Strategy Report
BTV	benchmark toxicity value
CRDL	contract-required detection limit
DFM	Data Fusion Modeling
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
gpad	gallons per acre per day
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
lbs	pounds
LCS	leachate collection system
LDS	leak detection system
mg/L	milligrams per liter
M gal	million gallons
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan
OSDF	on-site disposal facility
pCi/L	picoCuries per liter
pCi/m^3	picoCuries per cubic meter
PRRS	Paddys Run Road Site
TLD	thermoluminescent dosimeter
WPRAP	Waste Pits Remedial Action Project
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter

Introduction

INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR THIRD QUARTER 2000

The U.S. Department of Energy (DOE) has prepared this report to meet the quarterly reporting obligation defined in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a) for the Fernald site. The IEMP quarterly status reports document the results of DOE's ongoing assessment of environmental conditions at and near the site as full-scale remediation of the Fernald site proceeds. The primary objectives of the report are to:

- Provide a summary of key environmental data collected to track and assess the effectiveness of site emission controls
- Provide Fernald stakeholders with a timely assessment of off-property impacts associated with implementation and operation of remedial actions at the Fernald site
- Document the performance of the groundwater remedy for the Great Miami Aquifer
- Document the status of natural resource impacts and restoration activities.

The information presented in the quarterly status report is primarily organized in summary data tables and graphics with minimal textual discussion. This reporting format summarizes the wide range of environmental and operational data collected each quarter. The data tables and graphical data displays are designed to allow readers to compare the data to historical information and applicable regulatory standards. The information summarized in the quarterly status reports is presented in greater detail in the site's annual integrated site environmental report submitted to the U.S. Environmental Protection Agency and Ohio Environmental Protection Agency by June 1 of each year.

This report will be the final quarterly status report submitted under the current IEMP reporting format. As discussed in the Draft Final IEMP, Revision 2 (DOE 2000c), the proposed new reporting format emphasizes timely data reporting along with more streamlined quarterly submittals. In the future, IEMP data will be reported to the regulatory agencies in the form of an electronic Data Extranet Site (i.e., the IEMP Data Information Site) along with written quarterly summaries. The annual integrated site environmental reports will serve as the comprehensive report for IEMP data, and will continue to be made available to the public in June of each year.

The first quarterly summary will be submitted to the regulatory agencies in April of 2001. It will cover all IEMP program data historically covered under the fourth quarter status report, as well as any subsequent IEMP data added to the IEMP Data Information Site on or before March 31, 2001.

Groundwater Remedy

1.0 GROUNDWATER REMEDY

This section summarizes the third quarter 2000 operational data for the aquifer remedy and the second quarter 2000 analytical data from groundwater monitoring. The material in this section satisfies the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a).

Figure 1-1 shows the sampling activities that contributed data to this section. Figure 1-2 identifies the IEMP groundwater extraction and monitoring wells by module/monitoring activity and Figure 1-3 shows the IEMP water level (groundwater elevation) monitoring wells. Figure 1-4 shows the location of the active aquifer restoration modules and extraction/re-injection wells.

1.1 OPERATIONAL ASSESSMENT

1.1.1 AQUIFER RESTORATION SYSTEM SUMMARY

Table 1-1 summarizes the operational data from the three active restoration modules for the third quarter of 2000. The South Plume and South Field (Phase I) Extraction Modules pumped a total of 449.478 million gallons of groundwater and removed 197.81 pounds of uranium during this reporting period. Due to the residual concentration of uranium not removed by the treatment system, 1.48 pounds of total uranium were returned back into the aquifer through re-injection, which was less than 1 percent of the total removed. The Re-Injection Module re-injected 63.881 million gallons of treated groundwater back into the aquifer for a net total extraction of 385.597 million gallons. To date, 6.202 billion gallons of groundwater have been pumped and 2,130 pounds of uranium have been removed from the aquifer. Figure 1-5 depicts the total groundwater pumped versus groundwater treated during the third quarter of 2000. Figure 1-6 shows the uranium removal indices for the South Plume and South Field (Phase I) Extraction Modules.

1.1.2 MODULE-SPECIFIC SUMMARIES

1.1.2.1 SOUTH FIELD (PHASE I) EXTRACTION MODULE

The module target pumping rate for the 11 active extraction wells was 1,900 gallons per minute (gpm) at the beginning of the quarter and was changed to 2,140 gpm during the quarter. For the majority of the period, all active extraction wells in the module, with the exception of Extraction Wells 31561 and 31562, were pumped at or above the rates specified in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997a).

Pumping rates were significantly lower in August and September of 2000 at Extraction Well 31561. In August, the well was down to replace a portion of the discharge pipe within the well, as a hole was discovered in the discharge pipe within the well, just above the pump. The well was also down from September 15th through the 20th for preventative maintenance and routine well screen chlorination. Extraction Well 31562 was off from July 2000 through the latter portion of August 2000 for well screen rehabilitation. The well was shut down for a much longer period than normally required for well screen rehabilitation (3 weeks) due to safety concerns regarding an over head power line in the vicinity of the well and the resultant measures required to address the concern prior to the rehabilitation work. When pumping resumed in September, the target pumping rate was increased from 200 to 290 gpm. The reasons for increasing the target pumping rate were: 1) because water withdrawn from the well indicated an increased total uranium concentration upon restart after rehabilitation, and 2) the recent increases in the total uranium concentration in Monitoring Well 3068 to the northeast of Extraction Well 31562. The increasing total uranium concentrations in Monitoring Well 3068 indicate that Extraction Well 31562 is remediating a larger portion of the plume than what was previously thought.

Extraction Well 31567's target pumping rate was increased from 100 to 250 gpm in August. This well's target pumping rate was increased in an effort to accelerate remediation of the uranium plume emanating from the former inactive fly ash pile area.

In addition, nominal pumping rates of the South Field extraction wells (not including Extraction Well 31566) were increased by 10 percent from August 21, 2000, through the end of August and again from September 15, 2000 to October 1, 2000. The opportunity to increase the pumping rates was made available by higher than average groundwater treatment capacity and lower than normal uranium concentrations in the site effluent (concentrations measured at the Parshall Flume [PF 4001]) to the Great Miami River. The pumping rate increases may continue, depending on the available treatment capacity and uranium concentrations in site effluent.

Table 1-2 provides operational details for this module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-2 and selecting the appropriate well number. Figure 1-18 provides the weekly total uranium concentrations for each extraction well in this module.

1.1.2.2 SOUTH PLUME MODULE

The South Plume Module target pumping rate was 2,000 gpm. For the majority of the period, the wells in this module (Figure 1-4), with the exception of Extraction Wells 32308 and 32309, were pumped at or above the rates specified in the Baseline Remedial Strategy Report. The monthly average pumping rates for Extraction Wells 32308 and 32309 were significantly lower in July and September than in August due to the guidelines in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project (DOE 1999b). The Operations and Maintenance Master Plan states that Extraction Wells 32308 and 32309, whose concentrations are generally higher than those of the original South Plume extraction wells, must be shut down when the re-injection wells are off line. A proposal to modify the Operations and Maintenance Master Plan by continuing to operate Extraction Wells 32308 and 32309 regardless of the status of the re-injection wells was forwarded to the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) in late September. This proposal was implemented upon approval by the EPA and OEPA in October. It is anticipated that this operational modification will allow more continuous operation of Extraction Wells 32308 and 32309 thereby yielding higher monthly average pumping rates.

To help compensate for well downtimes (due to maintenance, electrical outages, etc.), pumping rates of Extraction Wells 32308 and 32309 were increased by approximately 20 percent from August 21 through September 13, 2000. The opportunity to increase the pumping rates was made available by higher than average groundwater treatment capacity and lower than normal uranium concentrations in the site effluent (concentrations measured at the Parshall Flume [PF 4001]). The pumping rate increases may continue, depending on the available treatment capacity and uranium concentrations in site effluent.

Table 1-3 provides operational details for the South Plume Module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-3 and selecting the appropriate well number. Figure 1-25 depicts the weekly total uranium concentrations for each well in this module.

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1.1.2.3 RE-INJECTION MODULE

The target re-injection rate for this module as specified in the Baseline Remedial Strategy Report was 1,000 gpm. Due to rehabilitation of each of the five re-injection wells during the third quarter, the target rate was not consistently maintained throughout the quarter (Table 1-4). Rehabilitation of the wells was required due to plugging in the formation and filter pack adjacent to the well screens and/or to clean out ion exchange resin found in the wells earlier this year, as previously reported in the Integrated Environmental Monitoring Status Report for Second Quarter 2000 (DOE 2000d).

The total uranium concentration trended downward in the injectate source water during third quarter 2000 (Figure 1-31) due to regeneration of a portion of the ion exchange resin in the treatment plant. Note that Figure 1-31 presents a non-continuous data set, as re-injection was not occurring continuously throughout the quarter.

Figure 1-31 provides explanations for system shut downs. Daily re-injection rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-4 and selecting the appropriate well number.

1.2 AQUIFER CONDITIONS

1.2.1 URANIUM PLUME

1.2.1.1 TOTAL URANIUM PLUME

Figure 1-32 depicts the total uranium plume contours for second quarter 2000. The plume contours were revised using second quarter data in the following locations: the Plant 6 area (Monitoring Well 2389); the northeastern edge of the South Field (Monitoring Well 3068); the eastern edge of the South Field (Monitoring Well 62433); and the waste storage area (Monitoring Well 2648). As detailed below, the contours do not honor the data for Monitoring Wells 2546 (Paddys Run Road Site [PRRS] area), 3027 (waste storage area), and 2426 (property boundary area east of the on-site disposal facility). Although the results are posted on Figure 1-32, a discussion of the changes made to the figure is provided below.

Plant Six Area: Monitoring Well 2389

The second quarter 2000 total uranium concentration at Monitoring Well 2389 was 22.7 micrograms per liter (µg/L), with a presampling turbidity of 174 nephelometric turbidity units (NTU). Reanalysis of this sample indicated a total uranium concentration of 21.7 µg/L, confirming the initial result. The previous result in December 1999 (well is sampled semi-annually) was 5.5 µg/L, with a turbidity of 14 NTU, while the June 1999 sample result was 14 µg/L, with a corresponding turbidity of 235 NTU. Based on these data, it appears that turbidity may be affecting the total uranium results at this monitoring well. The next sample from the well will be collected in December 2000. Both a filtered and an unfiltered sample will be collected, at this well in December if the turbidity is above 5 NTU, to better quantify the effect turbidity is having on the uranium analysis.

Northeastern Edge of the South Field: Monitoring Well 3068

A total uranium increase at Monitoring Well 3068 indicates that the total uranium plume is expanding in this area. The second quarter 2000 total uranium concentration at Monitoring Well 3068 was 100.7 µg/L, up 36.5 µg/L from the first quarter of 2000. However, direct-push sampling conducted in November of 2000 at Location 12817, which is west of Monitoring Well 3068 (Figure 1-32), indicates that there is no total uranium plume in the aquifer immediately up gradient from Monitoring Well 3068. The highest total uranium concentration at Location 12817 was 2.2 µg/L. The lack of a plume up gradient from Monitoring Well 3068 indicates a local problem around the well. A camera survey of Monitoring Well 3068 was completed on November 21, 2000 to look for potential problems within the well. The camera survey indicated leakage into the well, as the casing above the water table was wet with an abundance of red material. The red material was presumed to be iron bacteria residue. Also, as the camera passed casing joints, it appeared that water accumulating at the joints was disturbed by the camera and ran down the casing. Based on visual appearance of the well, it is inferred that contaminated surface and/or perched water has been leaking into the well. To determine if this is the

case, a pumping operation of Monitoring Well 3068 is being planned similar to that conducted for Monitoring Well 3027 in October 2000. The results of the pumping action will be communicated to EPA and OEPA via the weekly teleconference and will be documented in future IEMP reports.

Eastern Edge of the South Field: Monitoring Well 62433

Based on direct-push sampling results from 1999 in the area east of this well, the total uranium increase at Monitoring Well 62433 indicates that the plume has slightly expanded in this area since the first quarter of 2000. The second quarter 2000 total uranium concentration at Monitoring Well 62433 was 418.0 µg/L, up 21.13 µg/L since the first quarter of 2000. The closest extraction well is located west of this location. If increases continue, then pumping changes will need to be considered in order to assure that capture of the plume is being achieved.

The Waste Storage Area: Monitoring Well 2648

Monitoring Well 2648 is located on the southeast corner of Waste Pit 4. The second quarter 2000 total uranium concentration at Monitoring Well 2648 was 74.1 µg/L, with a presampling turbidity of 35 NTU, up 53.0 µg/L since November of 1999. In November of 1999, the total uranium concentration was measured at 21.05 µg/L, with a presampling turbidity of 1 NTU. Direct-push sampling (Location 12616) was also conducted next to Monitoring Well 2648 in late November/early December of 1999. The results were reported in Table C-3 of the Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas Report (DOE 2000b) that was issued in May 2000. The direct-push sampling results indicated that the highest total uranium concentration measured was 2.1 µg/L.

To honor the 74.1 µg/L value, the 20 µg/L contour was shifted to the east, and a 50 µg/L contour was added around Monitoring Well 2648. As reported in Appendix A, Attachment 2, of the 1999 Integrated Site Environmental Report (DOE 2000a), it is suspected that turbidity may be affecting total uranium concentrations at this well. Thus, future sample collection may employ filtration methods if turbidity is greater than 5 NTU.

Measurements Not Honored on the Map

Contours were not adjusted at Monitoring Well 2546, although the unfiltered total uranium concentration was 40.0 µg/L. This result was due to a presampling turbidity of 999 NTU. A 10-fold reduction in concentration was observed upon 0.45 micrometer filtration of the sample; the total uranium filtered sample result was 0.48 µg/L. As noted in the IEMP, Revision 2 (DOE 2000c), this well is being deleted from the groundwater monitoring program because it is not owned by the Fernald site nor was it installed or developed to Fernald site standards.

Contours were also not changed at Monitoring Well 3027 despite the total uranium result of 40.3 µg/L. The U.S. Department of Energy (DOE) transmitted preliminary data to EPA and OEPA from a 20,000 gallon pumping action at Monitoring Well 3027 (completed October 2, 2000) in the October 10 and 17, 2000 weekly site conference calls. These data indicated that there was not a total uranium concentration above 20 µg/L in the vicinity of Monitoring Well 3027. As discussed in the October 24, 2000 site conference call, because the sample results confirm that Monitoring Well 3027 has been leaking, DOE recommended plugging the well as soon as possible to protect the aquifer. As agreed upon by DOE and EPA and OEPA, the well was plugged and abandoned on October 27, 2000, just after it was sampled for all IEMP required constituents.

The initial analysis of the second quarter 2000 sample from Monitoring Well 2426 (located on the eastern property boundary) yielded a total uranium concentration of 24.2 µg/L, with a presampling turbidity of 10 NTU. The sample was collected with the micropurge technique. This represents an increase of 20.6 µg/L since the first quarter of 2000. As illustrated in Figure A.2-54 of the 1999 Integrated Site Environmental Report, prior to the second quarter of 2000, the total uranium concentration measured at this well had never been above 20 µg/L. The second quarter sample was reanalyzed with a result of 10 µg/L. Preliminary sampling results from third quarter 2000 indicate that the total uranium concentration is 6.31 µg/L, with a presampling turbidity of 8 NTU. Therefore, it appears that the original analysis of the second quarter sample is suspect and that a greater than 20 µg/L total uranium plume does not exist at this location. However, in accordance with the IEMP, DOE will continue to monitor and trend total uranium concentrations at this well, and will provide updates in future IEMP reports. Also, given that the location of this well is generally down gradient from the Plant 6 area (a known source of aquifer contamination), direct-push sampling of the aquifer in the area between Monitoring Well 2426 and Plant 6 is being conducted. Results of this sampling will be communicated to EPA and OEPA via the weekly teleconference. These results will then be reported in future IEMP reports.

1.2.2 GROUNDWATER ELEVATIONS AND CAPTURE ASSESSMENT

1.2.2.1 GROUNDWATER ELEVATIONS AND CAPTURE ASSESSMENT

Groundwater elevation measurements for the third quarter of 2000 were collected from July 17 through 20, 2000. The Type 2 well measurements are contoured in Figure 1-33. The figure also contains some Type 6 well measurements (Type 6 wells are screened at a slightly deeper interval than Type 2 wells), which are posted to achieve better lateral coverage across the map area. Actual pumping rates for each module from July 17 through July 20, 2000, are posted on the figure to document the pumping conditions on these dates.

Past experience at the Fernald site has shown that with a large number of wells (approximately 180) being measured each quarter, some measurement, transcription, or data entry errors occur (typically less than five percent). These errors often become apparent when the data are posted to maps and the contouring process begins. When the errors are identified, the erroneous data points are removed from the data set to be contoured in order to produce a water level map that represents aquifer conditions. Water level measurements in two monitoring wells were not used in the July data set because the measurements were inconsistent with other wells in their respective areas. The inconsistent measurements were observed in Monitoring Wells 2107 and 2394.

Capture of the main portion of the South Plume (north of PRRS above the 20 µg/L total uranium final remediation level) continued during the third quarter of 2000 due to pumping in the South Plume Module (refer to Figure 1-34). This figure shows the predicted steady state groundwater elevations based on the VAM3D groundwater flow model with the South Field (Phase I) Extraction, Re-Injection, and South Plume Modules operating as specified in the Baseline Remedial Strategy Report. For comparative purposes, the 10-year, uranium-based restoration footprint (capture zone), the maximum total uranium plume outline (updated with second quarter 2000 data), and the interpreted capture zones from the groundwater elevation map (Figure 1-33) are also shown on the figure. Note that the modeled capture zone and the capture zone derived from the July water level measurements appear to be in good agreement in the vicinity of the South Plume Module and the actual capture zone in the South Field area appears to be more extensive than the modeled capture zone.

1.2.2.2 SOUTH PLUME ADMINISTRATIVE BOUNDARY

Table 1-5 presents results of the second quarter 2000 PRRS constituent samples for arsenic, phosphorus, potassium, and sodium. Results were generally lower than the historical averages. However, the arsenic concentration at Monitoring Well 2625 was a new maximum concentration, the phosphorus concentration at Monitoring Well 3900 was a new maximum concentration, and the potassium concentration at Monitoring Well 2625 was also a new maximum concentration. In reviewing the second quarter data for these locations it was noted that the turbidity result of the samples were >999 NTU, 213 NTU, and >999 NTU, respectively. Note that the sample at Monitoring Well 2625 was collected via a bailer, and the sample at Monitoring Well 3900 was collected via micropurge. The unusually high second quarter results are being attributed to the high turbidity of the samples.

One volatile organic compound was detected during the second quarter of 2000 in a well used for monitoring PRRS constituents. Toluene was detected in the May 3, 2000 groundwater sample from Monitoring Well 3128. The validated laboratory result was 0.1 µg/L with a laboratory and validation qualifier of "J" which means an estimated result below the contract-required detection limit (CRDL). This detection is two orders of magnitude below the CRDL of 10 µg/L. It is not believed that this toluene result is an indication of capture of the PRRS plume. Toluene is less dense than water; therefore, it would be expected to be present near the top of the water column in Type 2 wells rather than Type 3 wells. Toluene is also a common laboratory contaminant. It was detected in a 1993 sample from Monitoring Well 2128 (validated result of 1.3 µg/L) but has not been detected since.

1.2.2.3 GROUNDWATER MODEL

The groundwater flow model has been successfully recalibrated to an October 1998 groundwater elevation data set and has been validated against three other quarterly elevation data sets (April 1998, June 1999, and October 1999). The re-calibration effort has been completed and the results are in the Great Miami Aquifer VAM3D Flow Model Re-calibration Report (DOE 2000f) which was submitted to EPA and OEPA in May 2000.

Phase II of the groundwater model upgrade project, which incorporates data fusion technology into the groundwater transport model has been completed. The information on this effort is provided in the Integration of Data Fusion Modeling (DFM) with VAM3DF Contaminant Transport Code Report (DOE 2000e) which was received from HydroGeoLogic, Inc. in April, and provided to EPA and OEPA in May 2000. Data fusion, when coupled with the contaminant transport code, provides a mechanism to allow the model to set transport parameters within pre-determined ranges to best match observed field data, thereby improving model predictions. Model output from data fusion also provides a quantitative measure of model uncertainty.

DOE is planning an evaluation and application phase for the DFM code, which began during the summer of 2000. The DFM code will not be used for decisions affecting the performance or design of the aquifer remedy until the evaluation and application activity has been completed and reviewed by EPA and OEPA.

Phase III of the groundwater model upgrade project, which consists of an optimization package, will not be started until the DFM code evaluation and application activity has been completed. When completed, it is anticipated that Phase III of the model upgrade will provide a decision support system to optimize extraction/re-injection well locations and pumping rates for the aquifer remedy.

TABLE 1-1

AQUIFER RESTORATION SYSTEM OPERATIONAL SUMMARY SHEET

	Reporting Period					
	July 2000 through September 2000			August 1993 through September 2000		
	Gallons Pumped/Re-Injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index[a] (lbs/M gal)	Gallons Pumped/Re-injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index[a] (lbs/M gal)
South Field (Phase I) Extraction Module	241.517	155.16	0.64	1,799.676	1,169.61	0.65
South Plume Module	207.961	42.65	0.21	5,218.301	994.77	0.19
Re-Injection Module	63.881	1.48	NA	815.622	34.67	NA
Aquifer Restoration Systems Totals						
(Extraction Wells)	449.478	197.81	0.44	7,017.977	2,164.38	0.31
(Re-Injection Wells)	63.881	1.48	NA	815.622	34.67	NA
(net)	385.597	196.33	NA	6,202.355	2,129.71	NA

[a]NA = not applicable

TABLE 1-2

**SOUTH FIELD (PHASE I) EXTRACTION MODULE
OPERATIONAL SUMMARY SHEET FOR THIRD QUARTER
(JULY 2000 THROUGH SEPTEMBER 2000)**

Extraction Well	31565	31564	31566[a,b]	31563	31567	31550	31560	31561	31562[a]	32276	32447[a]	32446[a]
	Baseline Remedial Strategy Report Target Pumping Rates (gpm)											
	200	200	200	200	100	100	100	100	100	200	NA	NA
	Average Pumping Rates (gpm)											
July	172	173	NA	173	115	94	96	94	0	252	181	189
August	206	206	NA	205	214	98	98	63	52	298	192	191
September	203	181	NA	211	265	105	105	84	247	315	197	197
Quarterly Average	194	187	NA	196	197	99	100	80	99	288	190	192
	Average Total Uranium Concentrations (µg/L)											
July	11.0	13.4	8.2	26.8	38.8	55.3	75.4	45.3	NS	145.3	206.5	90.4
August	10.0	12.7	2.8	24.2	33.5	50.7	70.7	42.4	179.7	134.9	194.8	88.6
September	9.4	12.6	8.1	22.3	32.7	50.7	70.8	49.5	138.0	136.3	189.6	82.1
Quarterly Average	10.1	12.9	6.4	24.4	35.0	52.2	72.3	45.7	158.9	138.8	197.0	87.0
	Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)											
July	0.09	0.11	NA	0.22	0.32	0.46	0.63	0.38	NA	1.21	1.72	0.75
August	0.08	0.11	NA	0.20	0.28	0.42	0.59	0.35	1.50	1.13	1.62	0.74
September	0.08	0.11	NA	0.19	0.27	0.42	0.59	0.41	1.15	1.14	1.58	0.68
Quarterly Average	0.08	0.11	NA	0.20	0.29	0.43	0.60	0.38	1.33	1.16	1.64	0.72

	Average Module Pumping Rate (gpm)		Water Pumped by Module (M gal)		Total Uranium Concentration from Module[c] (µg/L)	
July	1,539		68.771			78.7
August	1,823		81.299			74.2
September	2,110		91.447			78.2
Quarterly Average	1,824	Total	241.517		Quarterly Average	77.0

[a]NA = not applicable; NS = not sampled
[b]Monthly sampling for total uranium resumed in May of 2000.
[c]Average is calculated from individual well total uranium concentrations and flow rates.

TABLE 1-3

SOUTH PLUME MODULE
OPERATIONAL SUMMARY SHEET FOR THIRD QUARTER
(JULY 2000 THROUGH SEPTEMBER 2000)

Extraction Well	3924	3925	3926	3927	32308[a]	32309[a]
	Baseline Remedial Strategy Report Target Pumping Rates (gpm)					
	300	300	400	400	250	250
	Average Pumping Rates (gpm)					
July	288	285	368	464	0	0
August	290	289	361	469	184	183
September	283	279	308	440	109	108
Quarterly Average	287	284	346	458	98	97
	Average Total Uranium Concentrations (µg/L)					
July	32.5	30.7	27.4	2.2	NS	NS
August	27.4	27.2	26.2	2.0	77.0	77.2
September	31.7	30.6	30.0	2.2	68.7	69.1
Quarterly Average	30.6	29.5	27.9	2.1	72.8	73.1
	Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)					
July	0.27	0.26	0.23	0.02	NA	NA
August	0.23	0.23	0.22	0.02	0.64	0.64
September	0.26	0.26	0.25	0.02	0.57	0.58
Quarterly Average	0.25	0.25	0.23	0.02	0.61	0.61

	Average Module Pumping Rate (gpm)	Water Pumped by Module (M gal)	Total Uranium Concentration from Module[b] (µg/L)
July	1,405	62.746	20.8
August	1,777	79.284	30.7
September	1,526	65.931	27.9
Quarterly Average	1,569	Total 207.961	Quarterly Average 26.5

[a]NA = not applicable; NS = not sampled
[b]Average is calculated from individual well total uranium concentrations and flow rates.

TABLE 1-4

RE-INJECTION MODULE
OPERATIONAL SUMMARY SHEET FOR THIRD QUARTER
(JULY 2000 THROUGH SEPTEMBER 2000)

Re-Injection Well	22107	22108	22109	22240	22111
	Baseline Remedial Strategy Report Target Re-Injection Rates (gpm)				
	200	200	200	200	200
	Average Re-Injection Rates (gpm)				
July	55	35	60	88	31
August	25	153	153	127	129
September	185	79	80	66	185
Quarterly Average	88	89	98	94	115

	Average Module Re-Injection Rate (gpm)	Water Re-Injected By Module (M gal)	Total Uranium Concentration from Module (µg/L)
July	268	11.954	7.4
August	587	26.187	1.0
September	595	25.740	1.7
Quarterly Average	483	Total 63.881	Quarterly Average 3.4

TABLE 1-5

PADDYS RUN ROAD SITE GROUNDWATER SUMMARY STATISTICS

		Sampling Period						
		January 1, 1988 through June 30, 2000					Sample Results for Second Quarter 2000	
Constituent[a]	Monitoring Well	Number of Samples[b,c,d]	Min.[b,c,d,e] (mg/L)	Max.[b,c,d,e] (mg/L)	Avg.[b,c,d,e] (mg/L)	SD[b,c,d,e] (mg/L)	Sample Result[f] (mg/L)	Validation Qualifier[g,h]
Arsenic	2128	213	0.000195	0.1876	0.013	0.022	0.0032	U
	2625	200	0.0048	0.0595	0.012	0.0091	0.0595	-
	2636	171	0.01	0.0939	0.04	0.02	NS	NA
	2898	28	0.00035	0.082	0.0044	0.015	0.0032	U
	2899	25	0.00032	0.0032	0.0013	0.00082	NS	NA
	2900	210	0.00032	0.0609	0.0053	0.0064	0.0032	U
	3128	31	0.00085	0.234	0.011	0.042	0.0032	U
	3636	30	0.0006	0.014	0.0019	0.0024	0.0032	U
	3898	28	0.0006	0.0062	0.0022	0.0012	0.0032	U
	3899	29	0.00032	0.003	0.0013	0.0078	0.0032	U
	3900	29	0.000395	0.0045	0.0023	0.0010	0.0032	U
Phosphorus	2128	39	0.025	16.2	2	3	0.05	UJ
	2625	25	0.307	12.3	3.31	3.18	1.85	J
	2636	23	9.6	170	95	50	NS	NA
	2898	29	0.005	1.7	0.1	0.4	0.441	U
	2899	24	0.005	0.11	0.04	0.03	NS	NA
	2900	27	0.07	4.74	0.6	0.9	0.178	U
	3128	38	0.005	13	0.4	2	0.05	UJ
	3636	29	0.00955	1.1	0.09	0.2	0.05	UJ
	3898	27	0.00955	1.24	0.11	0.24	0.05	UJ
	3899	28	0.00955	0.83	0.12	0.17	0.05	U
	3900	29	0.005	1.38	0.14	0.3	1.38	J
Potassium	2128	31	0.83	18	3.9	4.5	3.56	-
	2625	25	0.64	9.49	3.7	2.0	9.49	-
	2636	23	8.51	218	82.4	54.7	NS	NA
	2898	29	1.11	7.78	3.86	1.14	5.66	J
	2899	25	1.36	4.66	3.57	0.626	NS	NA
	2900	28	0.0095	6	1.9	1.3	2.16	J
	3128	31	1.085	3.7	2.4	0.66	1.66	-
	3636	29	1.09	4.24	2.50	0.597	2.57	-
	3898	28	0.61	3.93	2.3	0.67	2.47	-
	3899	29	0.875	3.22	2.38	0.426	2.43	J
	3900	29	0.975	3.19	1.9	0.50	1.8	-
Sodium	2128	31	22.9	75.2	37.4	12.6	27.7	-
	2625	25	16.5	50.7	34.0	7.77	38.8	-
	2636	23	23	79.9	47	16	NS	NA
	2898	29	4.945	29.2	18.0	4.64	17.2	-
	2899	25	11.2	22.9	17.0	3.16	NS	NA
	2900	28	0.01355	43.3	28.5	9.52	29.1	-
	3128	31	3.56	13.4	6.41	3.28	3.61	-
	3636	29	3.98	13	8	3	5	-
	3898	28	7.29	14.6	9.43	1.93	11.3	-
	3899	29	6.24	12.1	8.56	1.41	7.44	-
	3900	29	3.56	10.8	6.00	1.94	3.68	-

[a]Summary statistics for volatile organics are not included because the vast majority of results are non-detects.
[b]The data are based on unfiltered samples from the Operable Unit 5 remedial investigation/feasibility study data set (1988 through 1993) and 1994 through 2000 groundwater data.
[c]If more than one sample is collected per well per day (e.g., duplicate), then only one sample is counted for the total number of samples, and the sample with the maximum concentration is used to determine the summary statistics (minimum, maximum, average, and standard deviation [SD]).
[d]Rejected data qualified with either a R or Z were not included in this count or the summary statistics.
[e]Where concentrations are below the detection limit, each result used in the summary statistics is set at half the detection limit.
[f]NS = not sampled due to well being dry.
[g]Validation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998).
[h]NA = not applicable

FIGURE 1-1

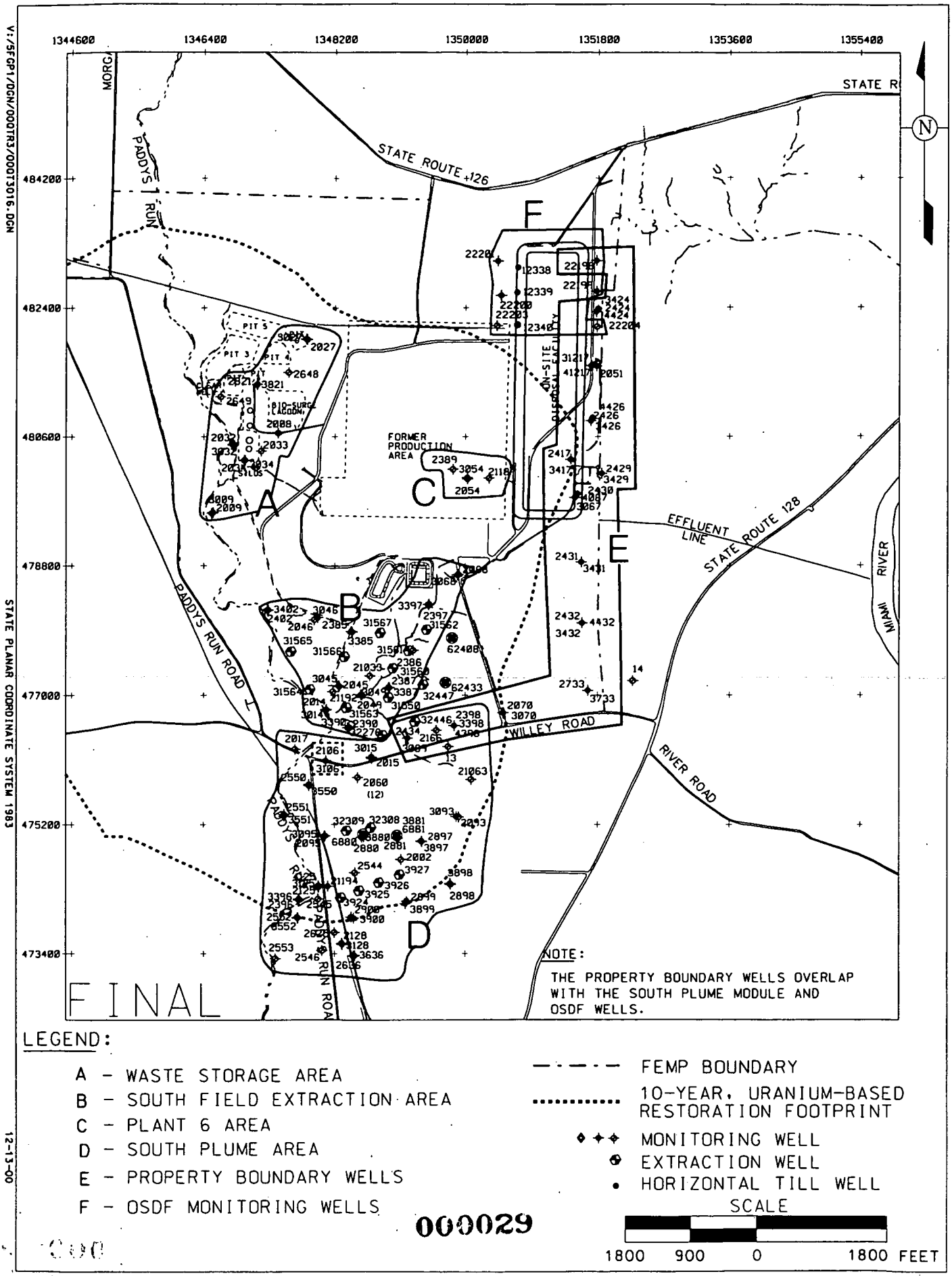
GROUNDWATER SAMPLING ACTIVITIES[a]

SAMPLING ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
South Plume Module:												
Operational							◆	◆	◆			
Aquifer Conditions					◆							
South Field Extraction Module:												
Operational (Phase I)							◆	◆	◆			
Aquifer Conditions						◆						
Re-Injection Module												
Operational							◆	◆	◆			
Aquifer Conditions					◆	◆						
Waste Storage Area Module:												
Pre-Design Monitoring												
Aquifer Conditions						◆						
Plant 6 Area Module:												
Pre-Design Monitoring												
Aquifer Conditions						◆						
Routine Water-Level/Flow Direction Monitoring							◆					
Property Boundary Monitoring				◆								
Private Well Monitoring				◆								

◆ Data summarized/evaluated in this report

FINAL

[a]Future data will be reported through the IEMP Extranet Site and quarterly summaries.



000029

FIGURE 1-2. IEMP WATER QUALITY MONITORING WELLS AND EXTRACTION WELLS

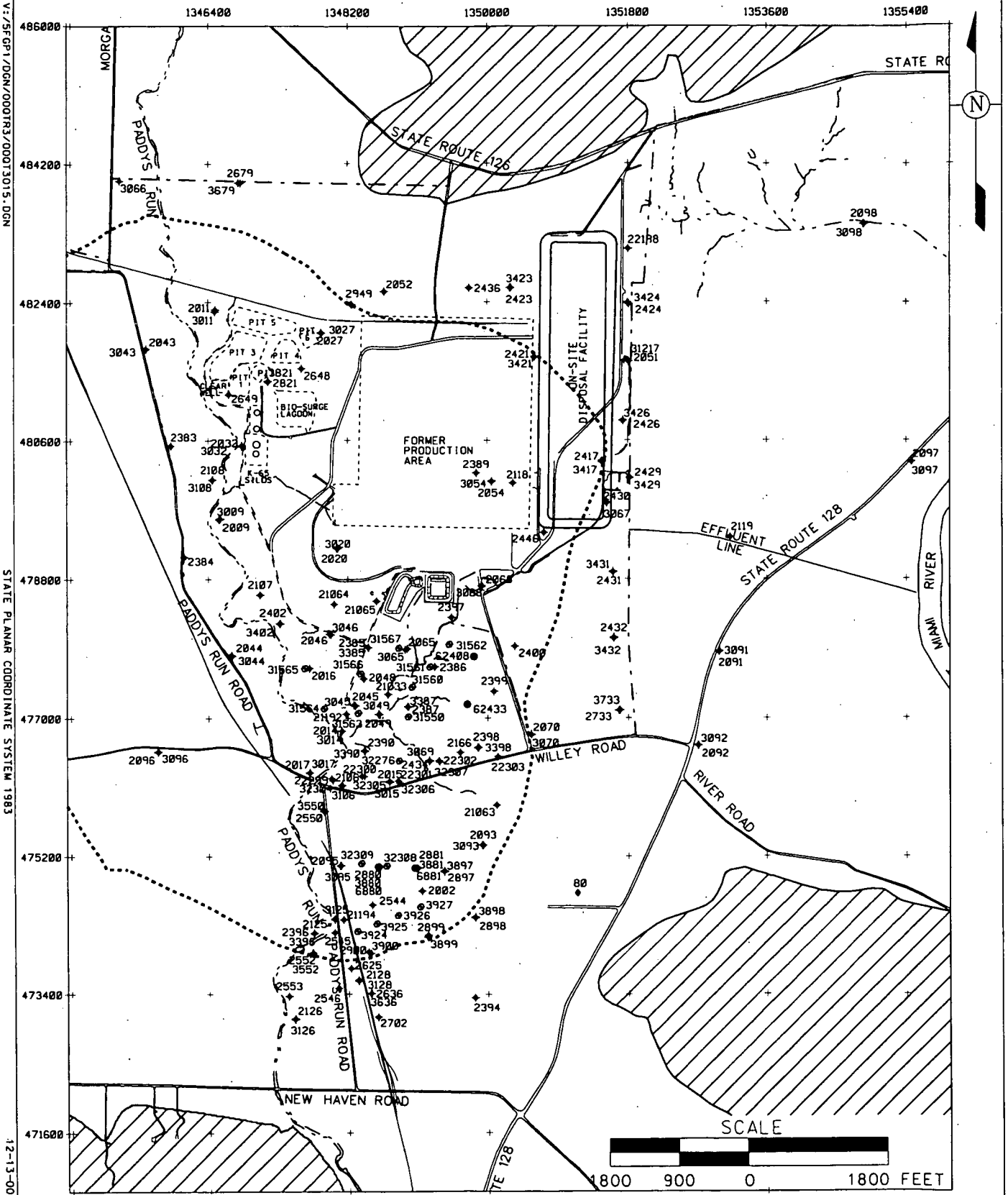
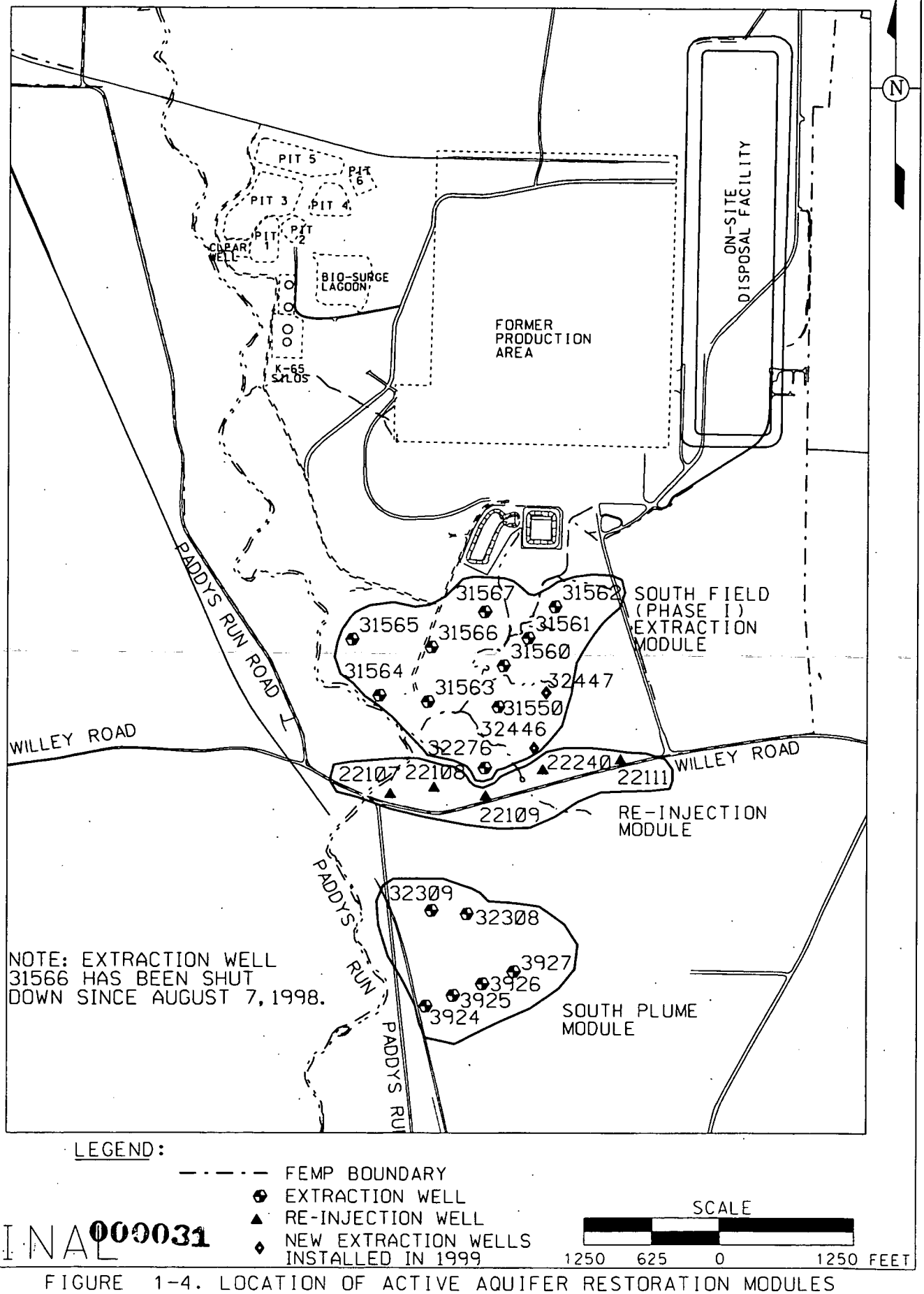


FIGURE 1-3. GROUNDWATER ELEVATION MONITORING WELLS



FINAL 000031

FIGURE 1-4. LOCATION OF ACTIVE AQUIFER RESTORATION MODULES

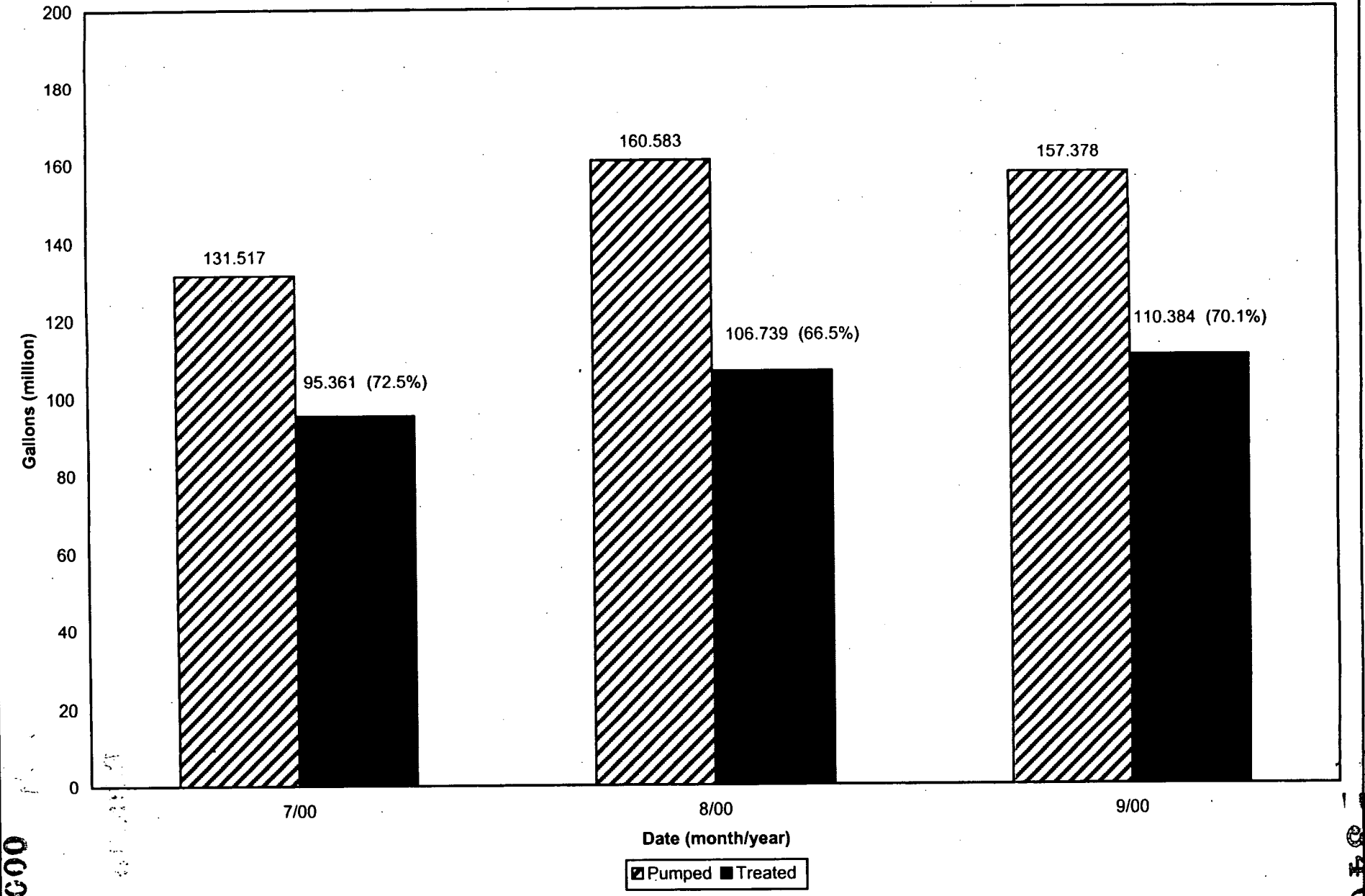


FIGURE 1-5. TOTAL GROUNDWATER PUMPED VS. GROUNDWATER TREATED FOR THIRD QUARTER 2000

FINAL

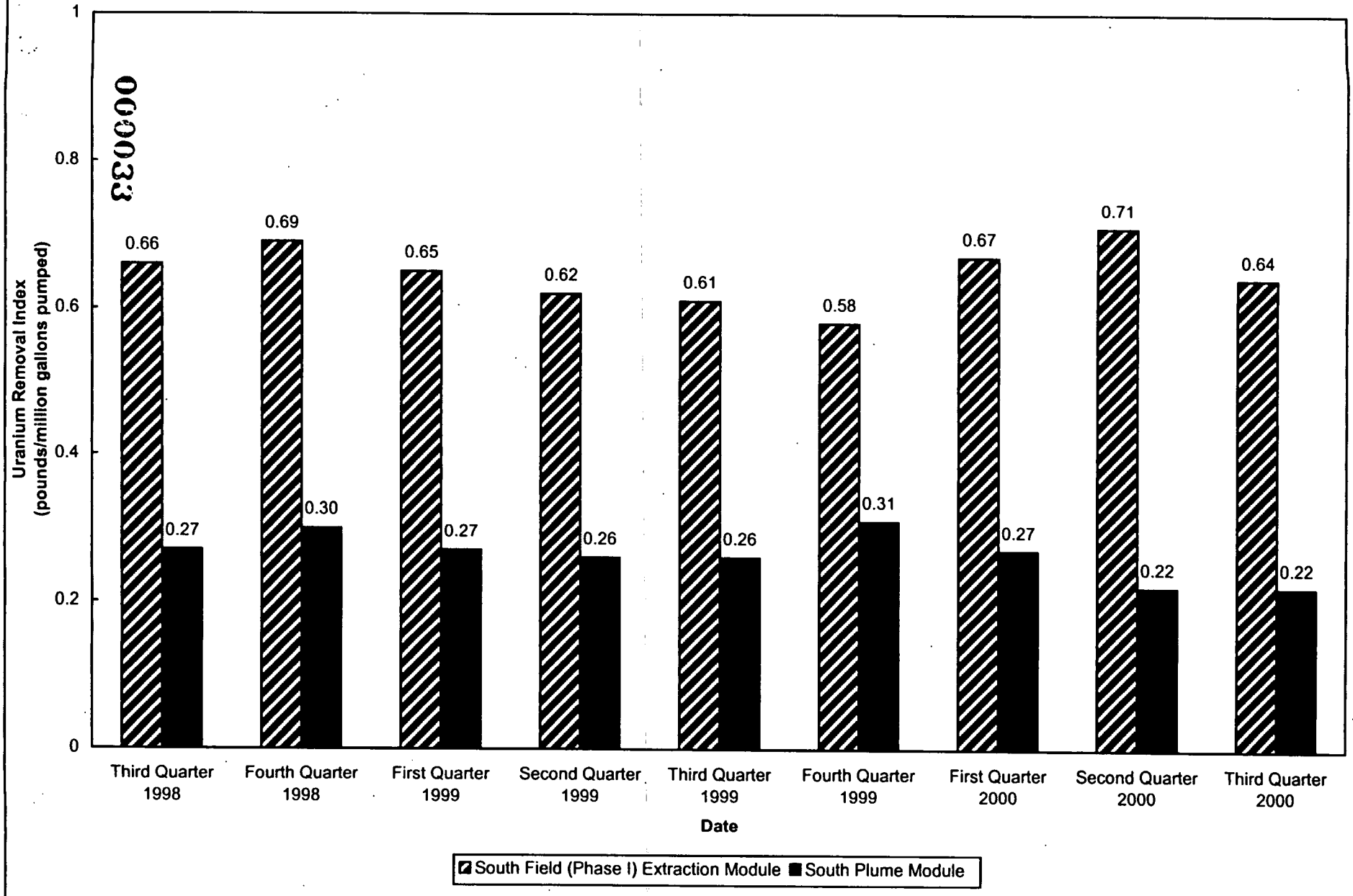


FIGURE 1-6. URANIUM REMOVAL INDICES BY MODULE

FINAL

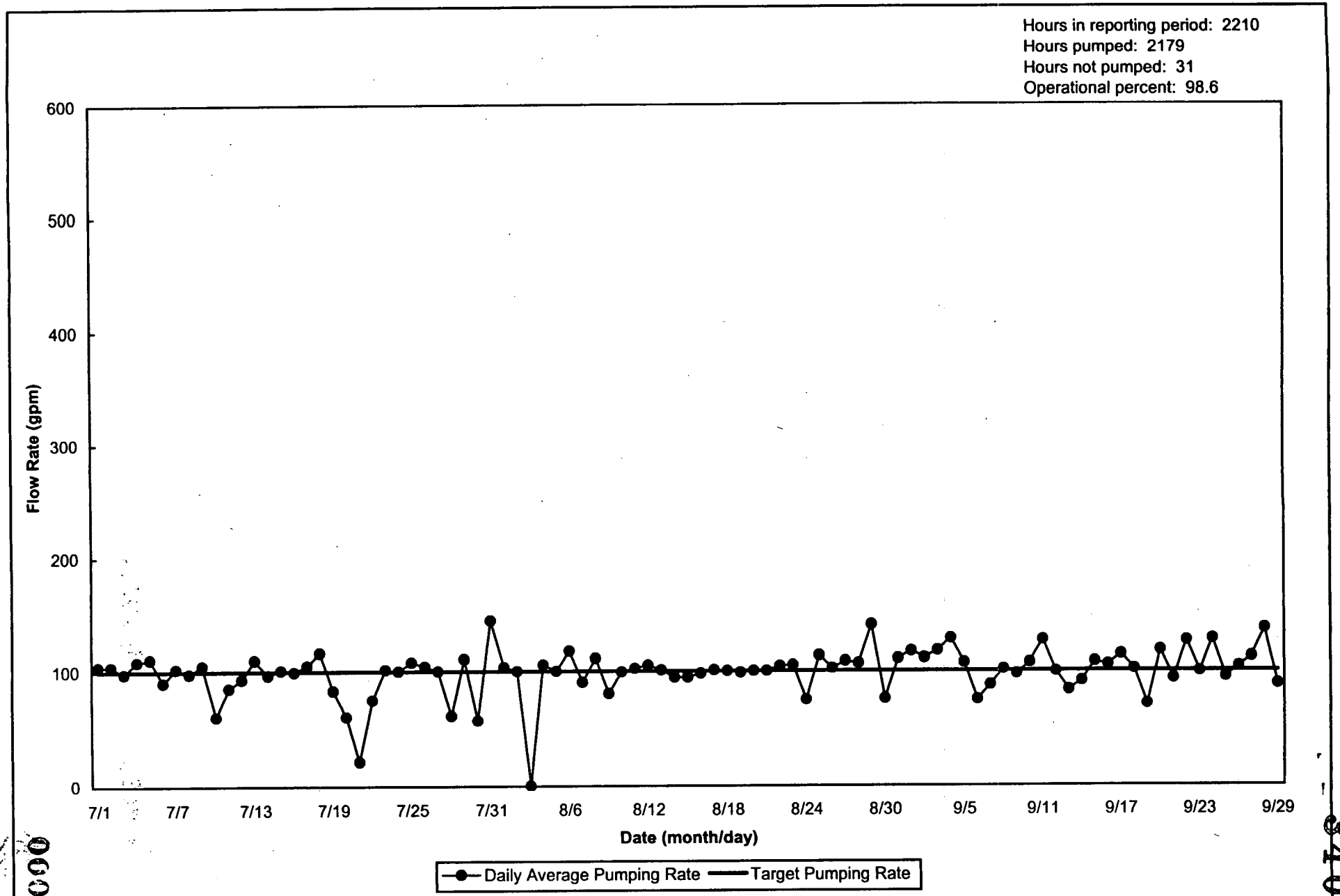


FIGURE 1-7. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31550, 7/00 - 9/00

FINAL

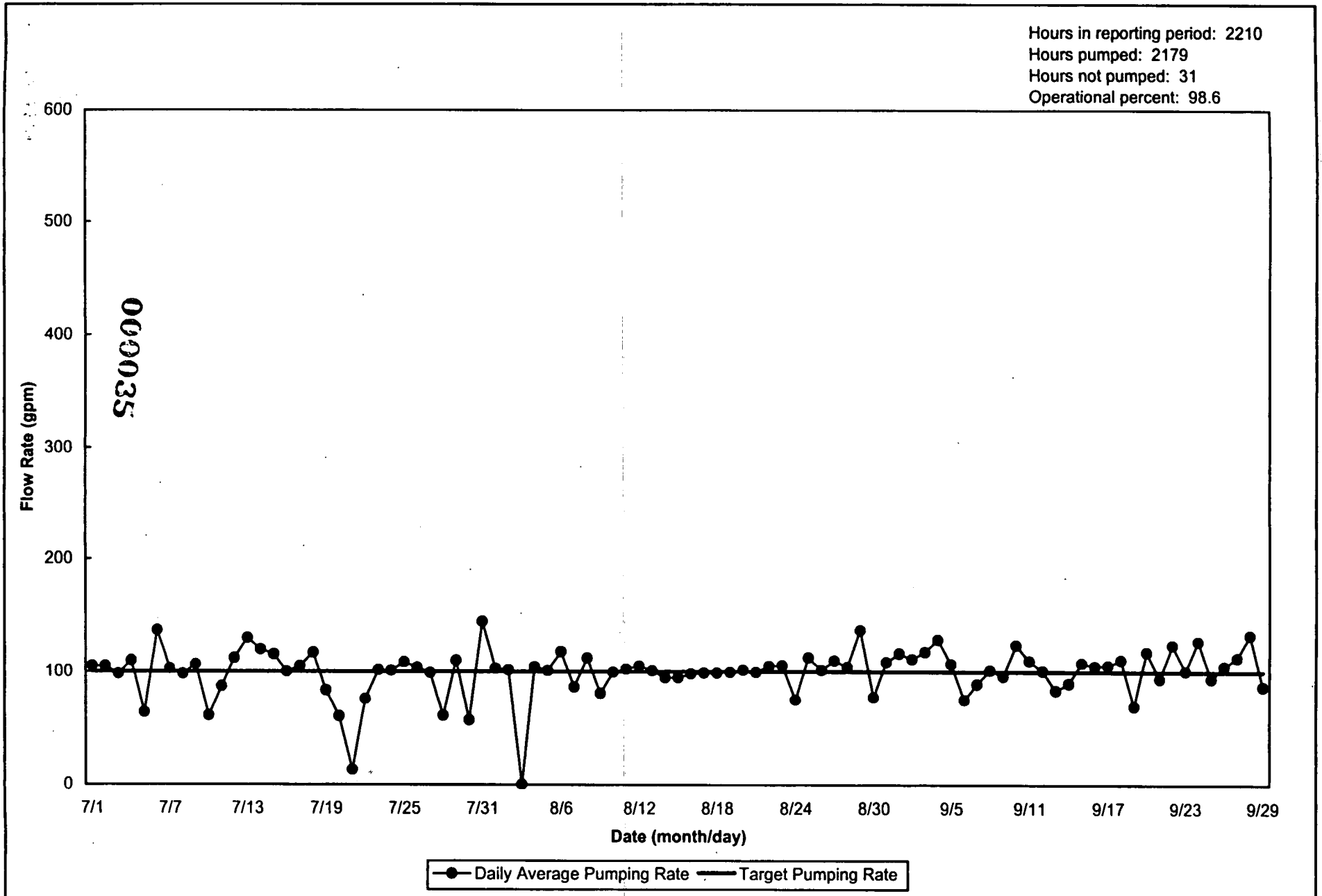


FIGURE 1-8. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31560, 7/00 - 9/00 FINAL

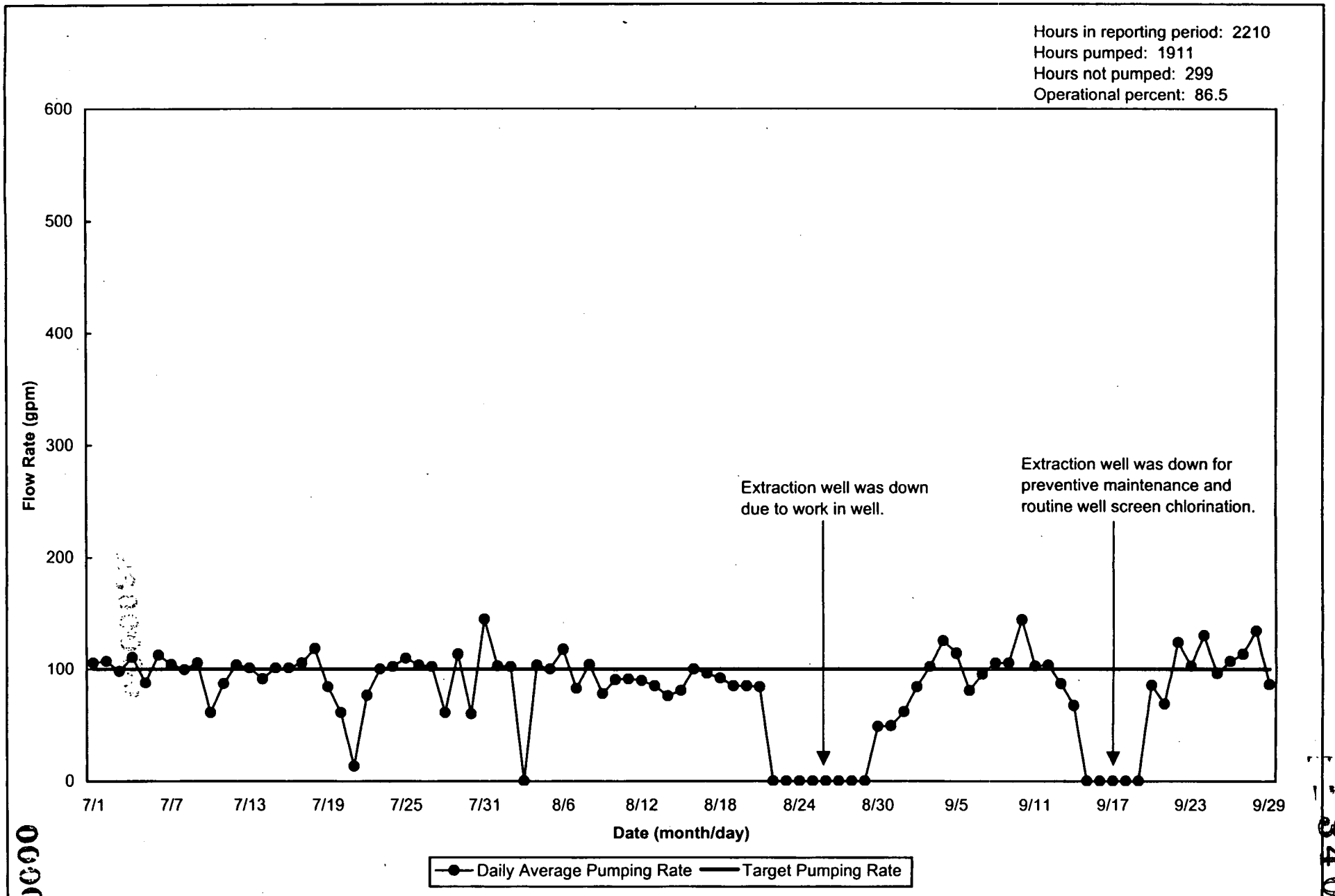


FIGURE 1-9. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31561, 7/00 - 9/00 FINAL

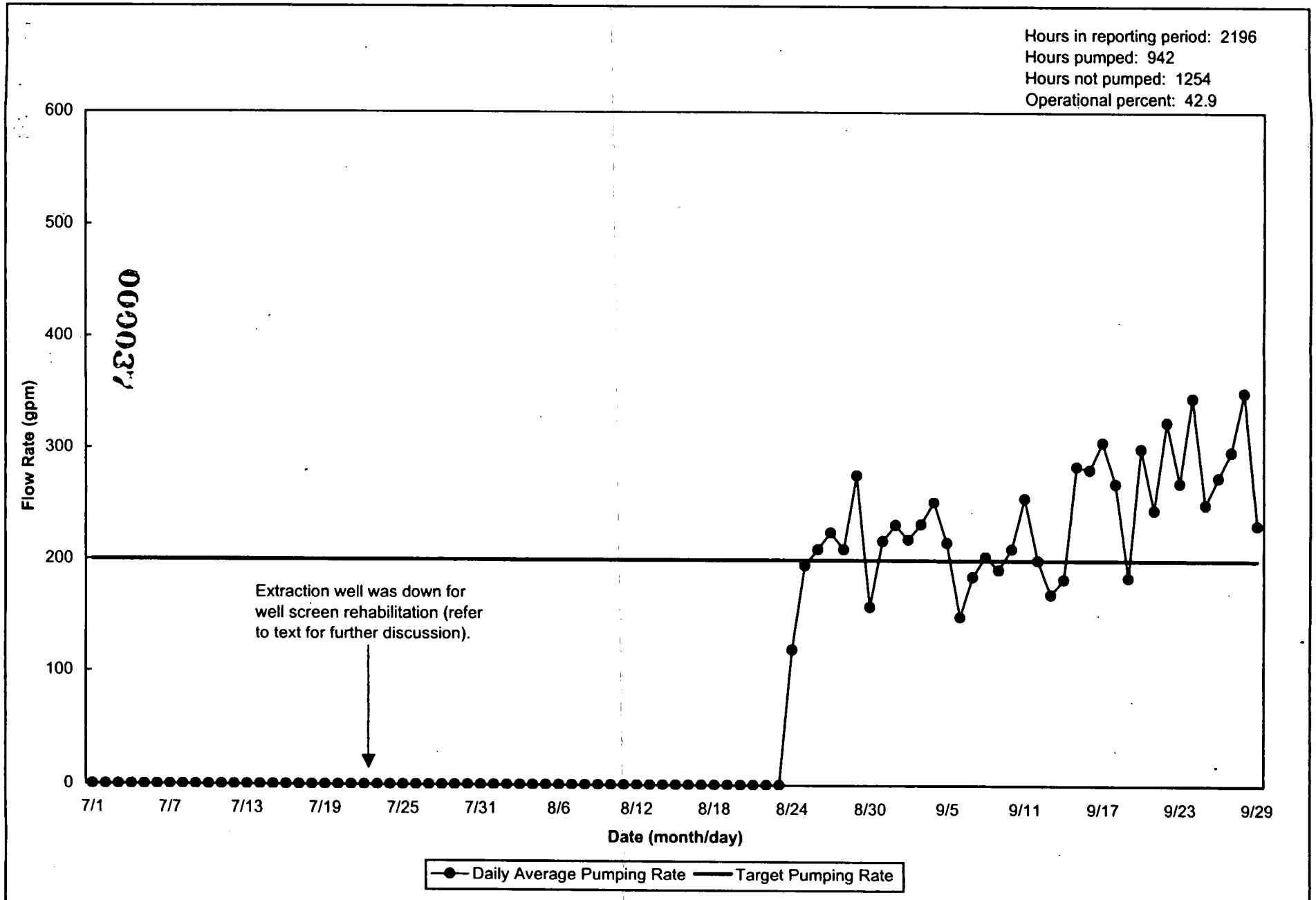


FIGURE 1-10. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31562, 7/00 - 9/00 FINAL

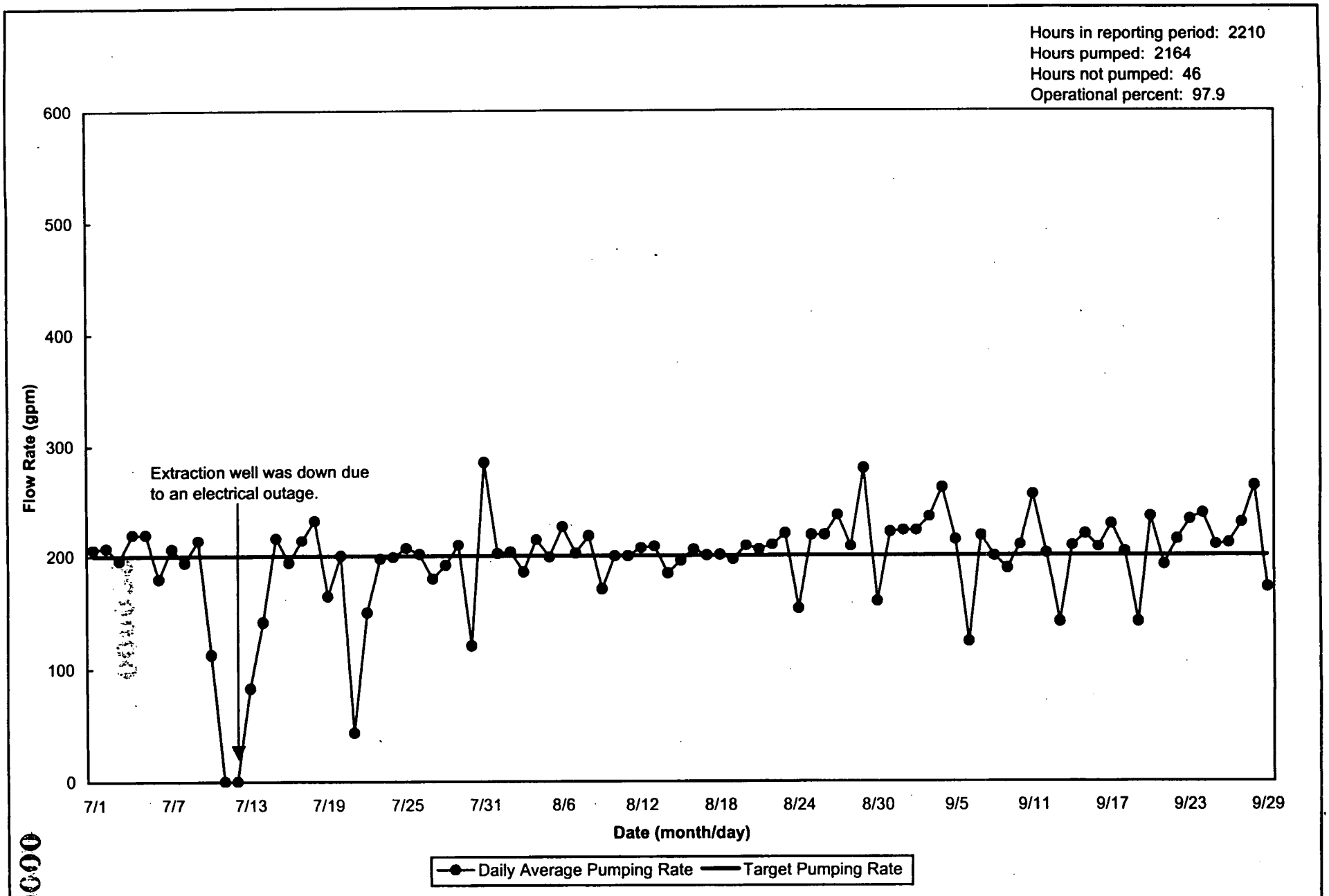


FIGURE 1-11. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31563, 7/00 - 9/00

FINAL

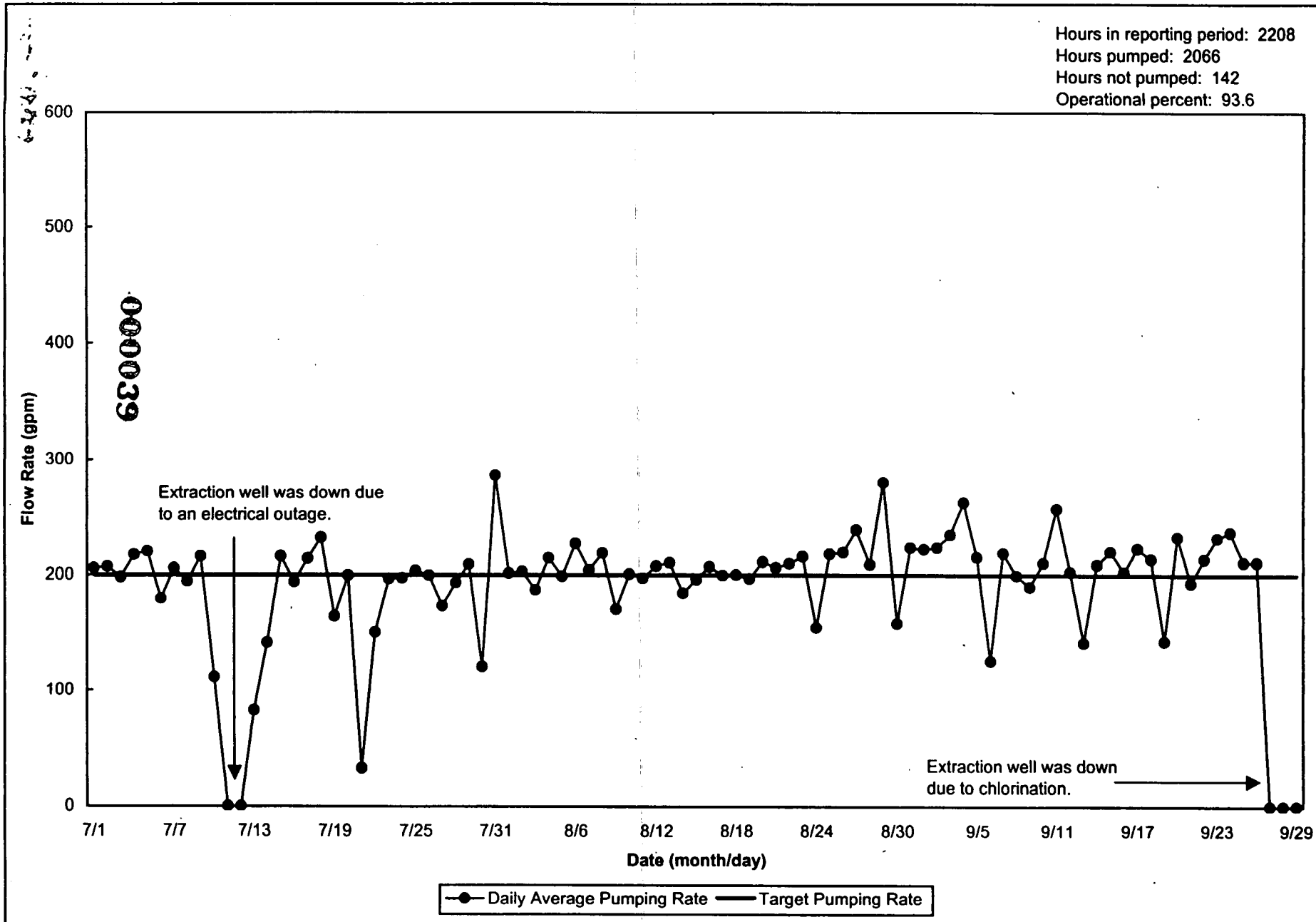


FIGURE 1-12. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31564, 7/00 - 9/00 FINAL

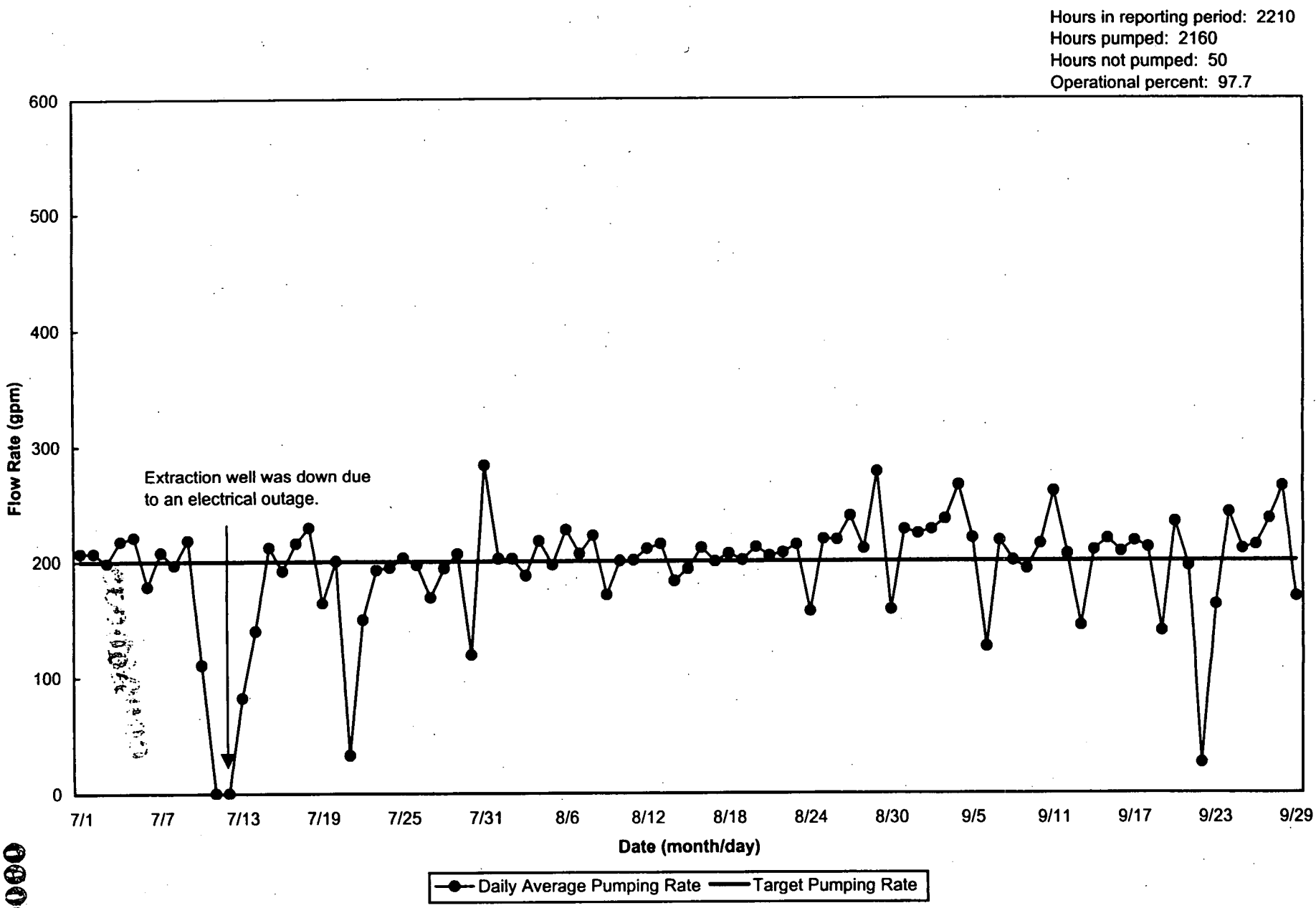


FIGURE 1-13. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31565, 7/00 - 9/00

FINAL

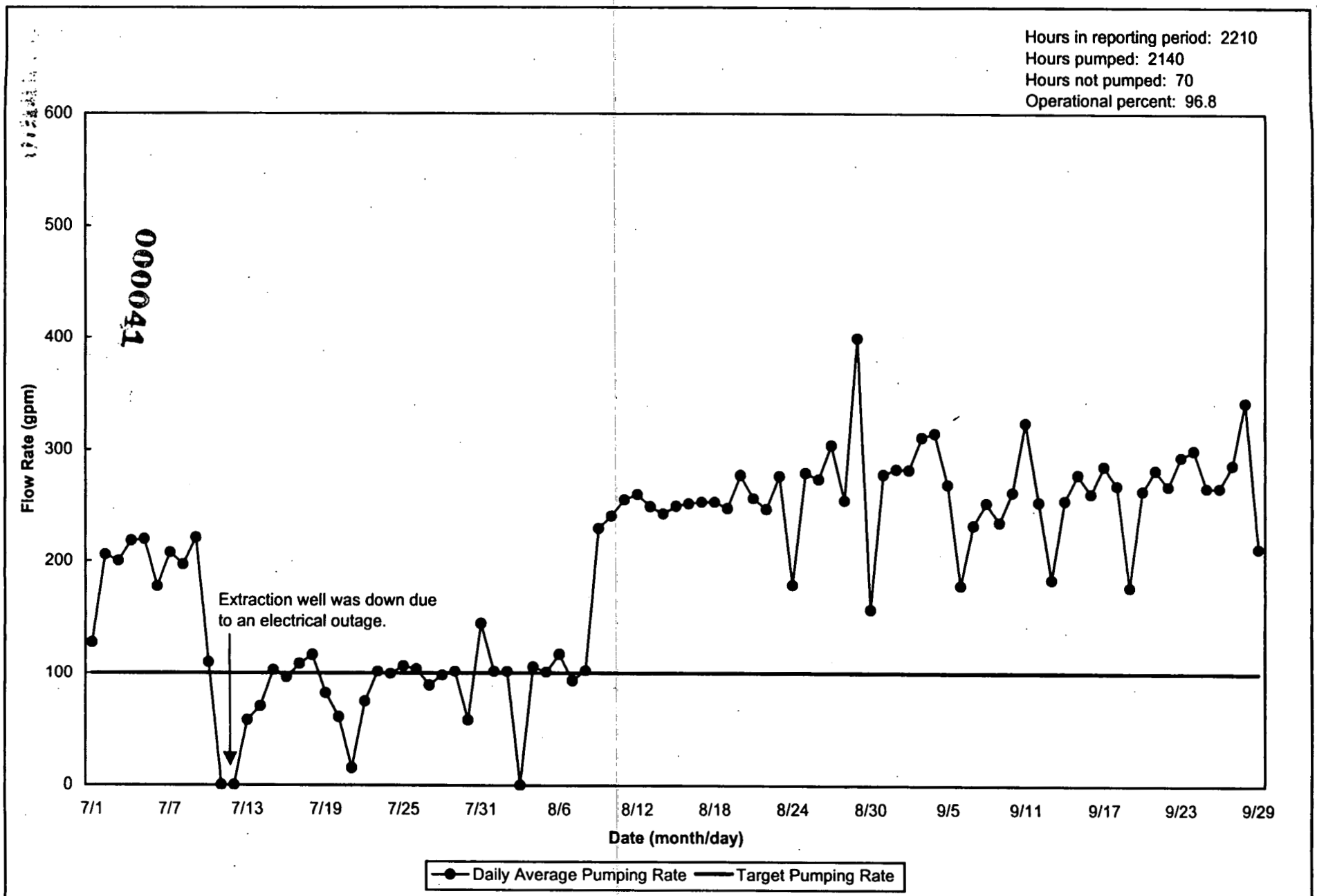


FIGURE 1-14. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31567, 7/00 - 9/00

FINAL

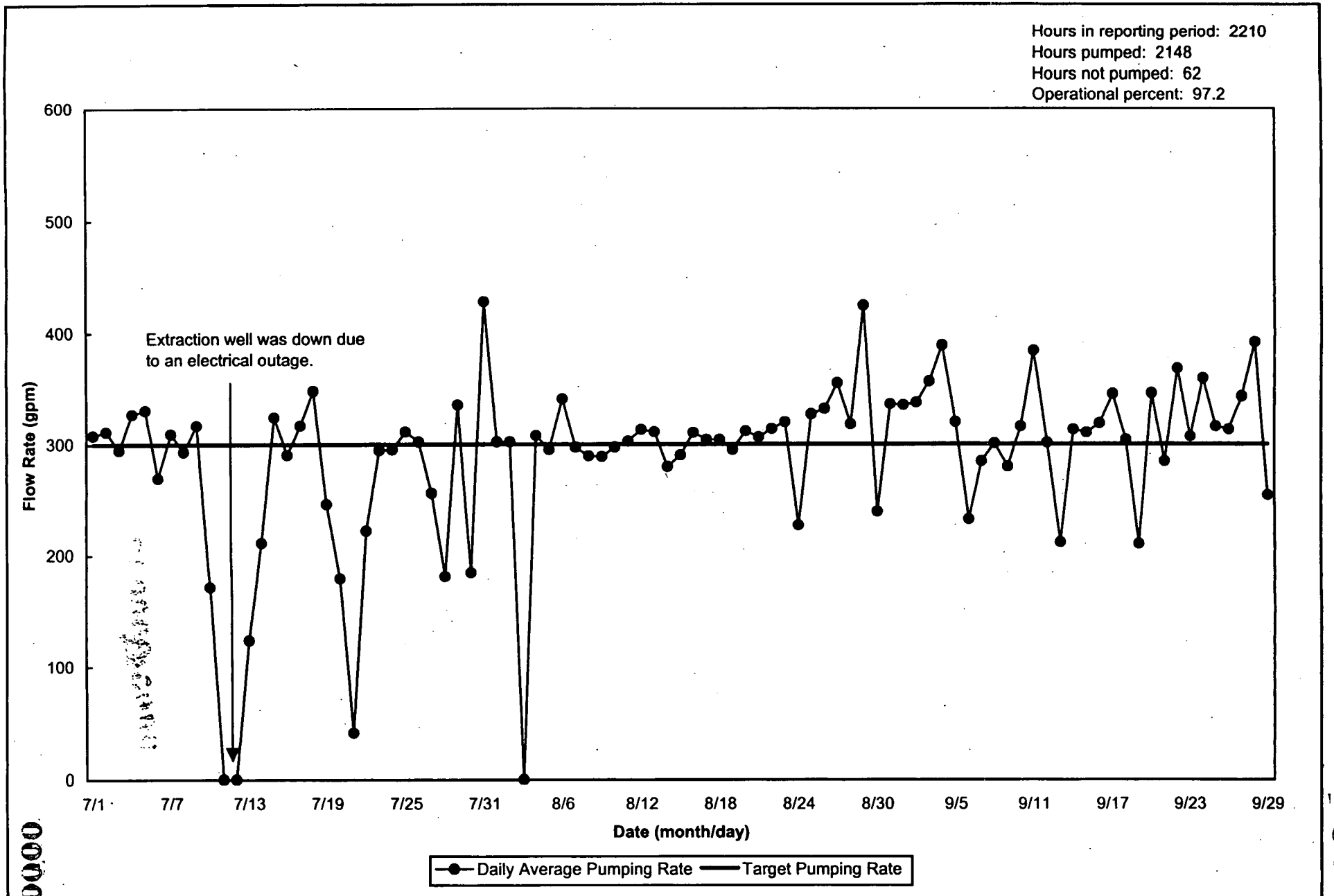


FIGURE 1-15. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32276, 7/00 - 9/00

FINAL

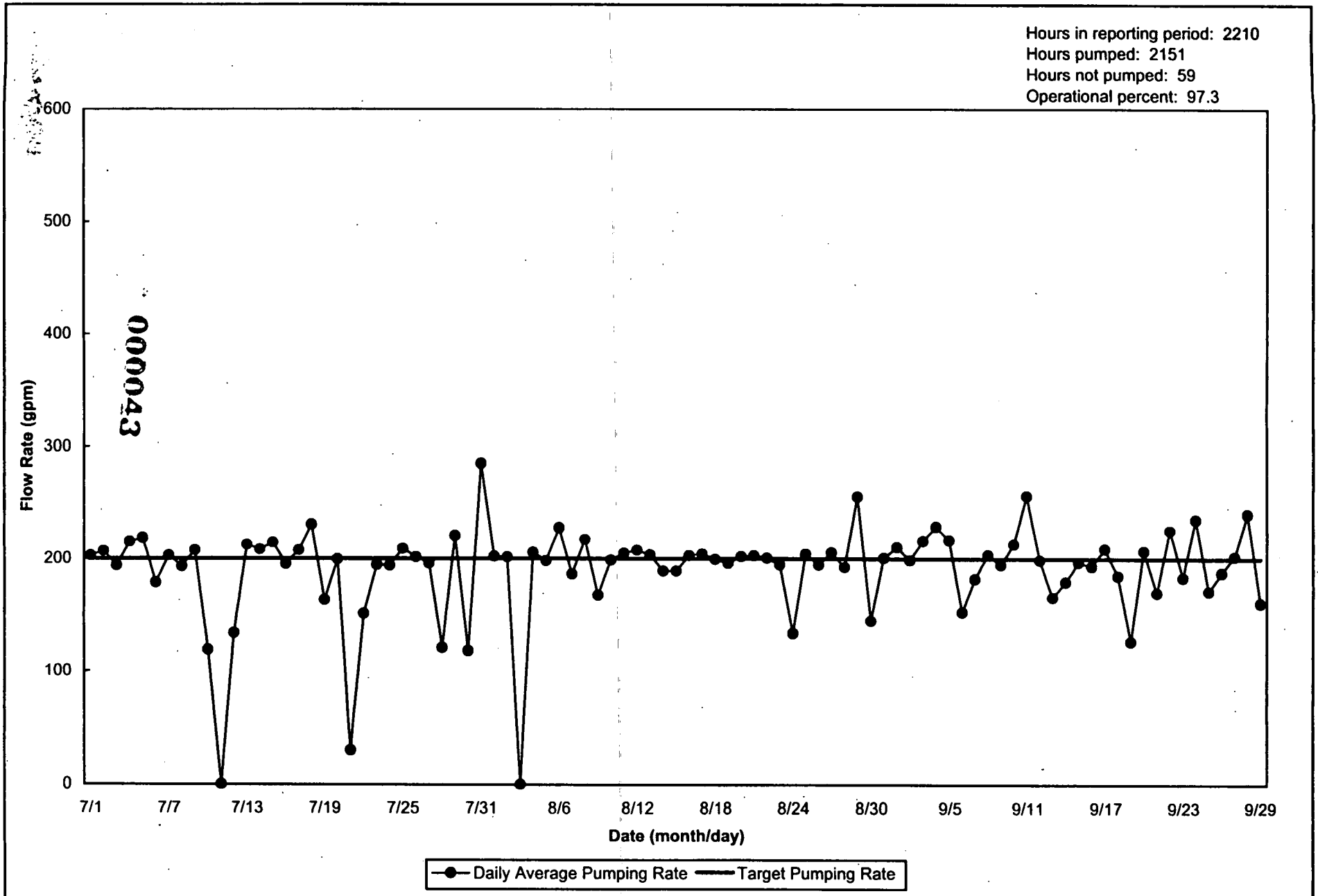


FIGURE 1-16. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32447, 7/00 - 9/00 FINAL

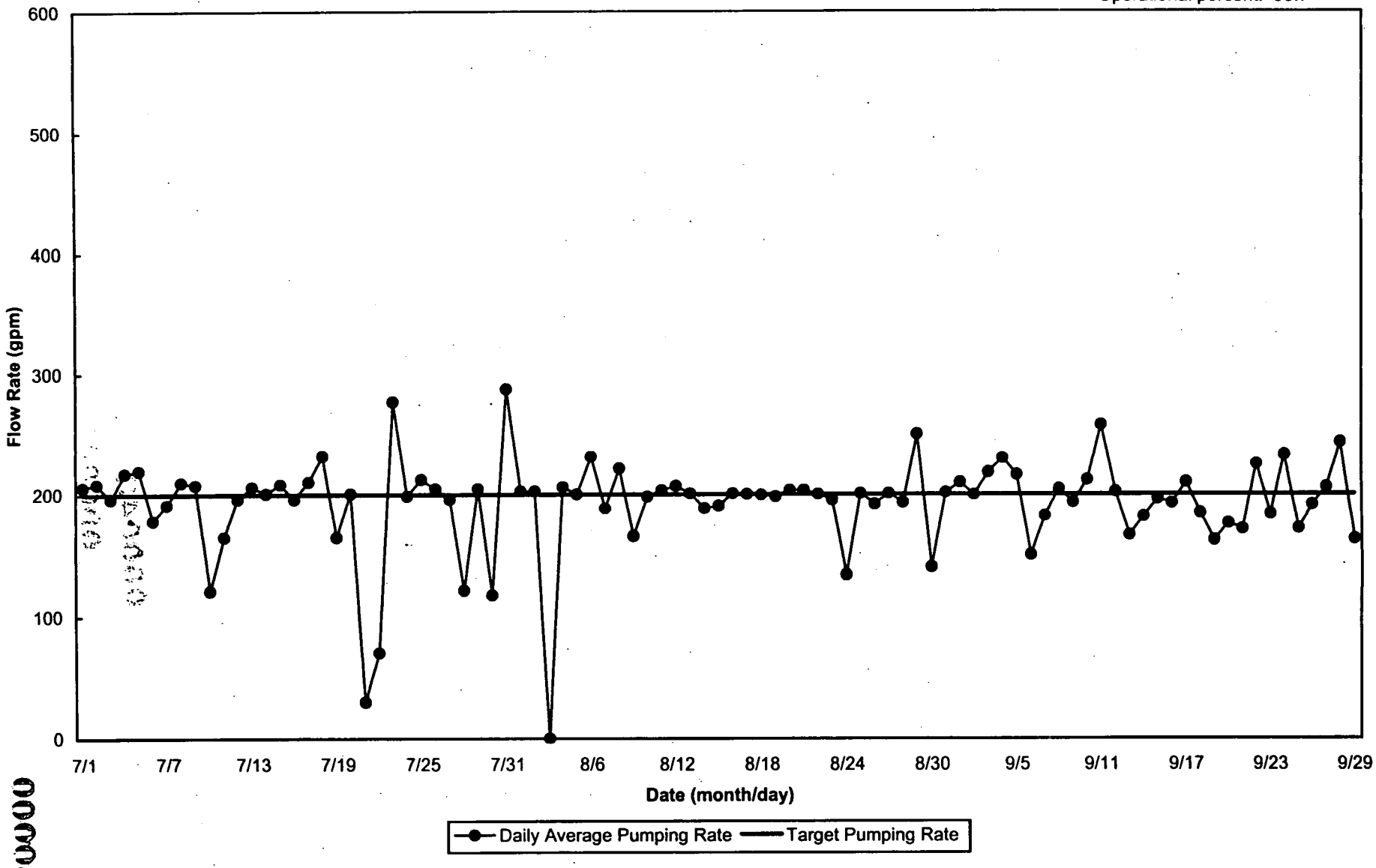
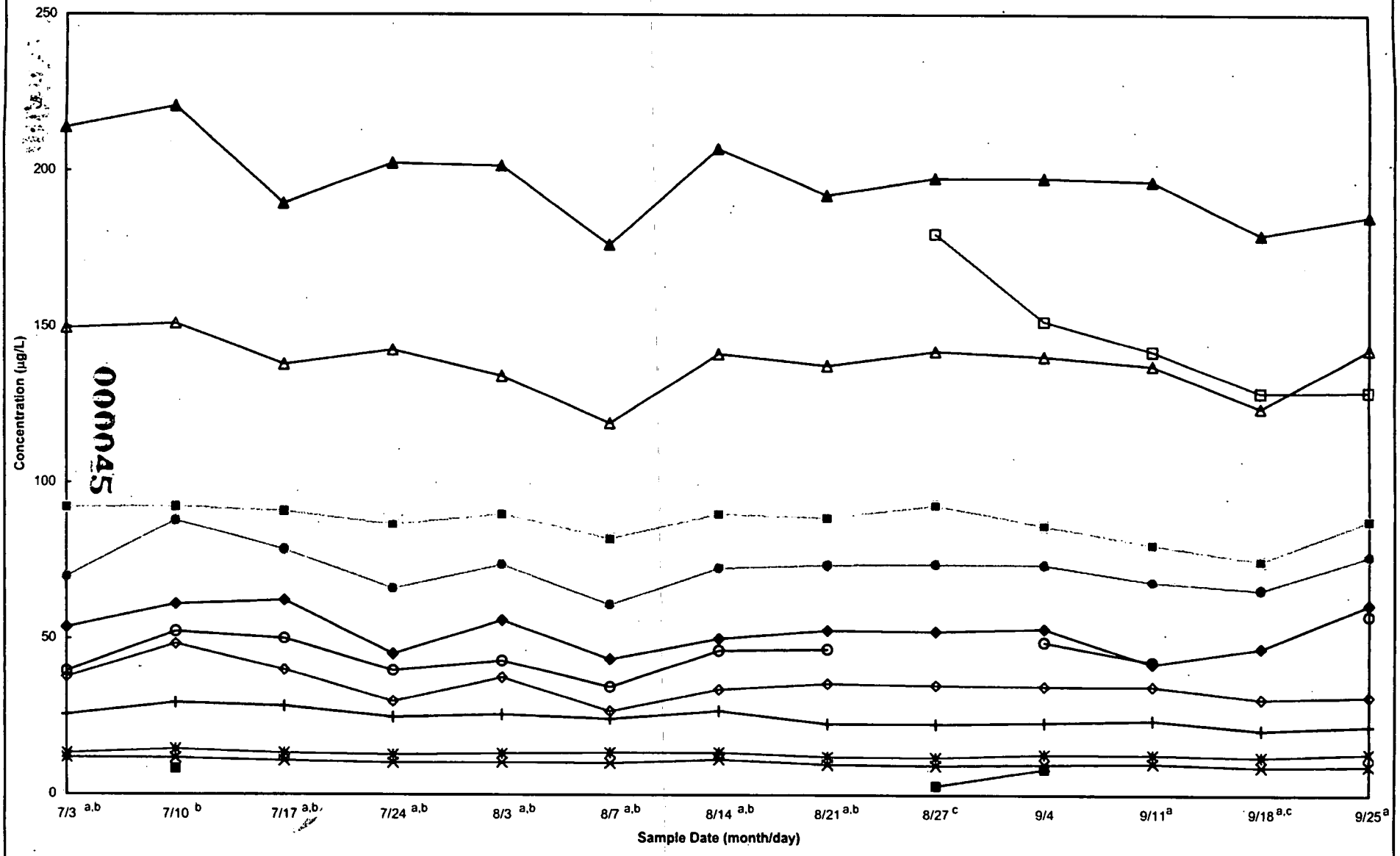


FIGURE 1-17. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32446, 7/00 - 9/00

FINAL



[a] A sample was not collected for Extraction Well 31566.

[b] A sample was not collected for Extraction Well 31562.

[c] A sample was not collected for Extraction Well 31561.

FIGURE 1-18. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH FIELD (PHASE I) EXTRACTION MODULE

FINAL

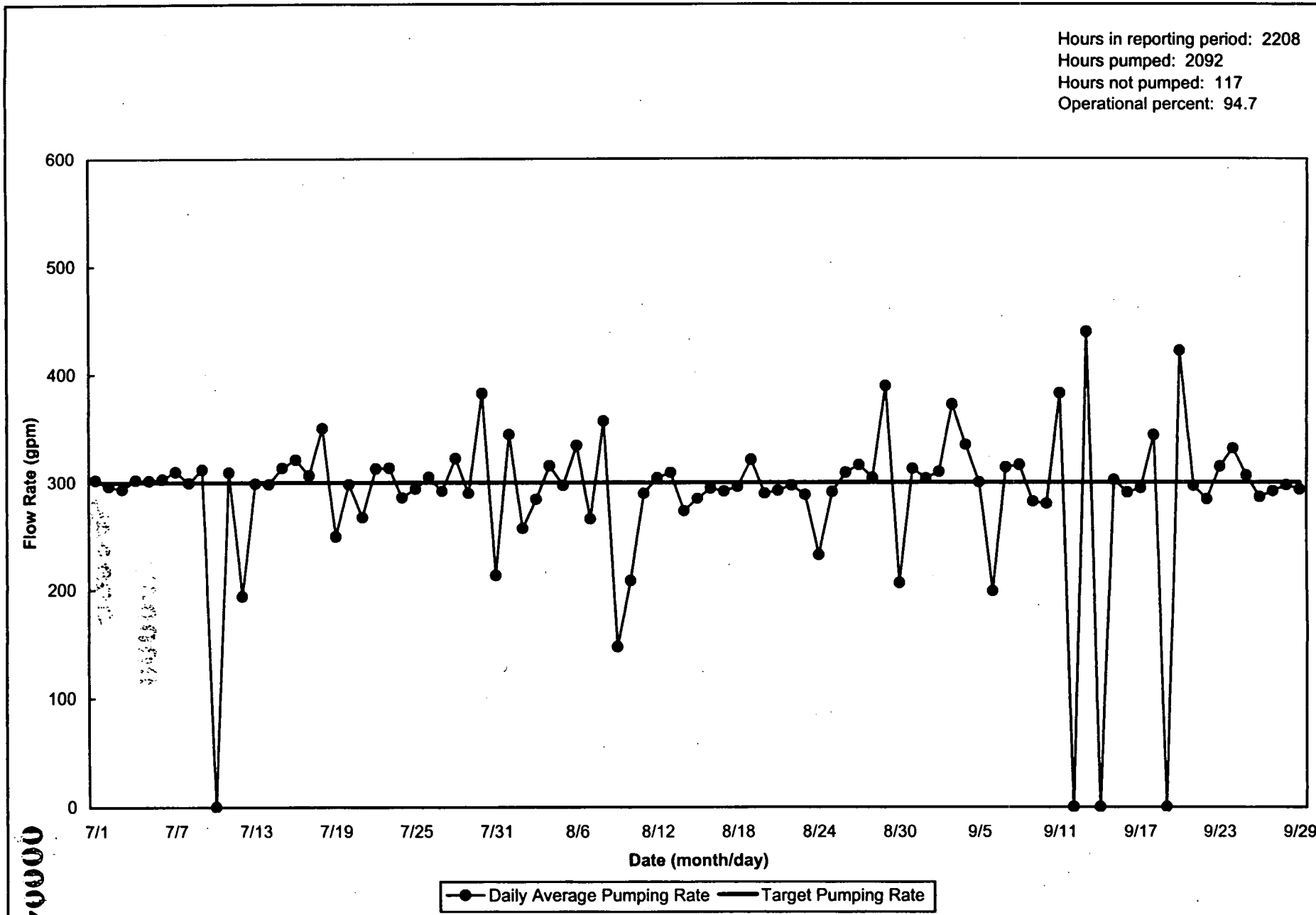


FIGURE 1-19. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3924, 7/00 - 9/00

FINAL

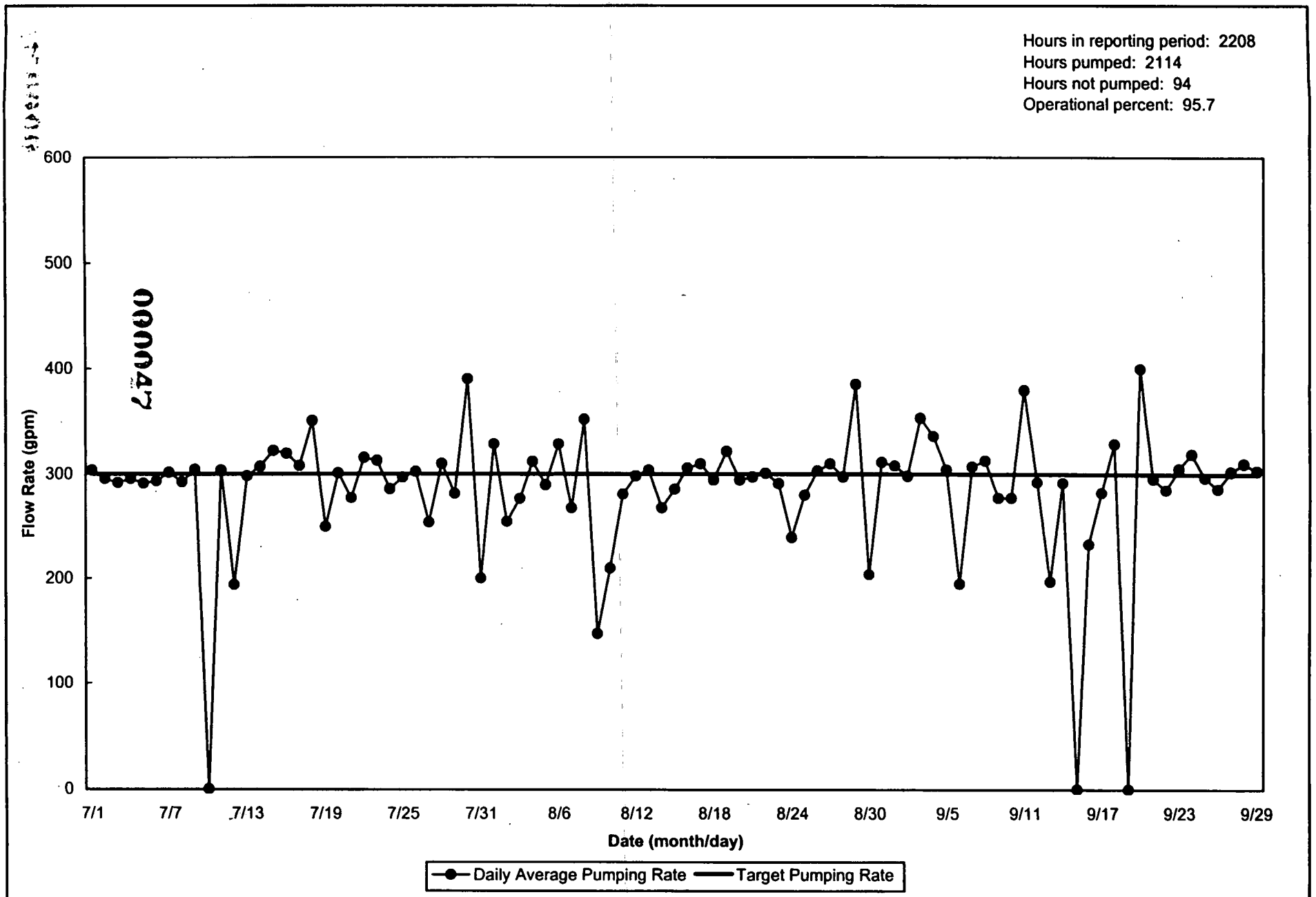


FIGURE 1-20. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3925, 7/00 - 9/00

FINAL

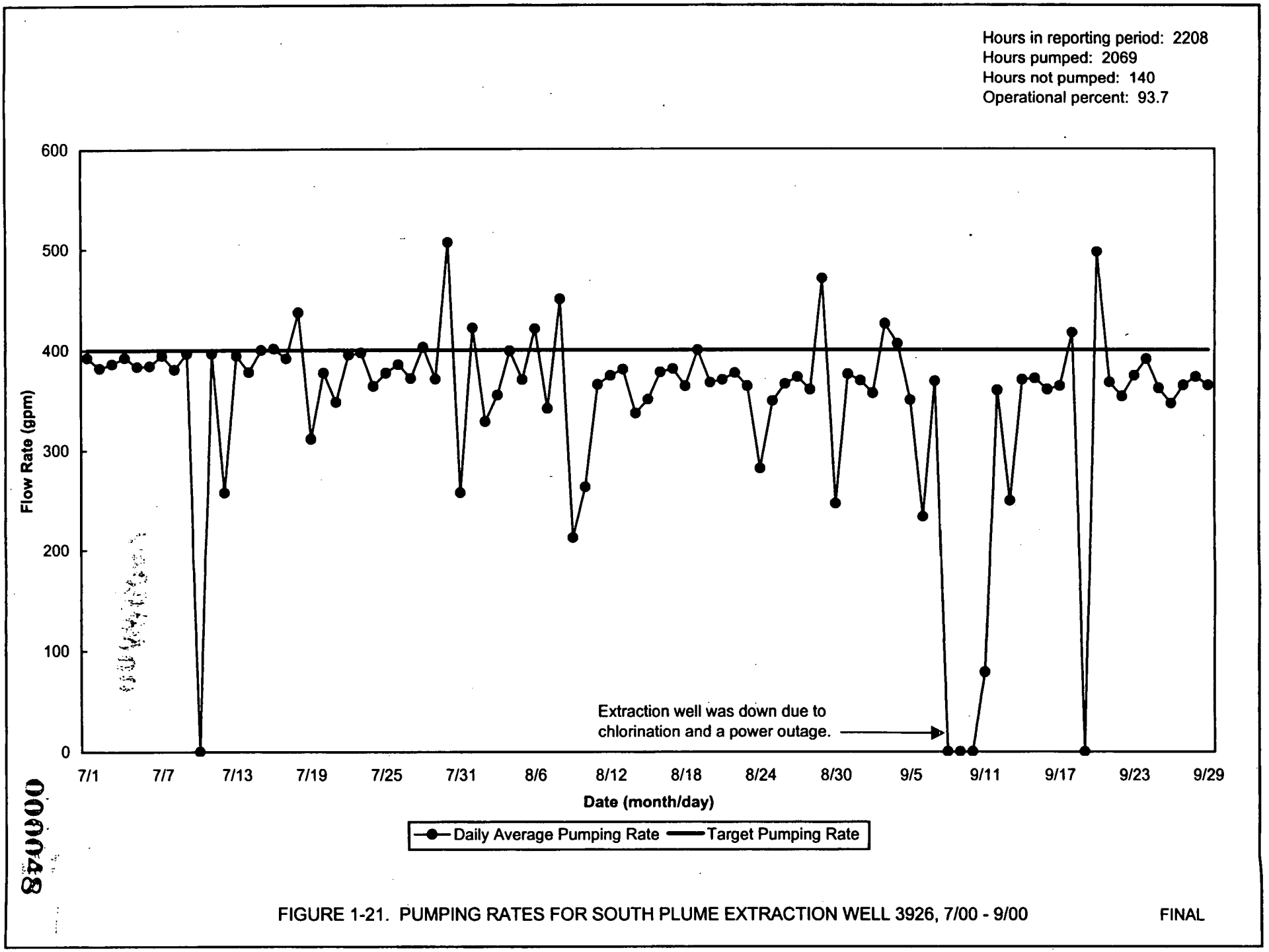


FIGURE 1-21. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3926, 7/00 - 9/00 FINAL

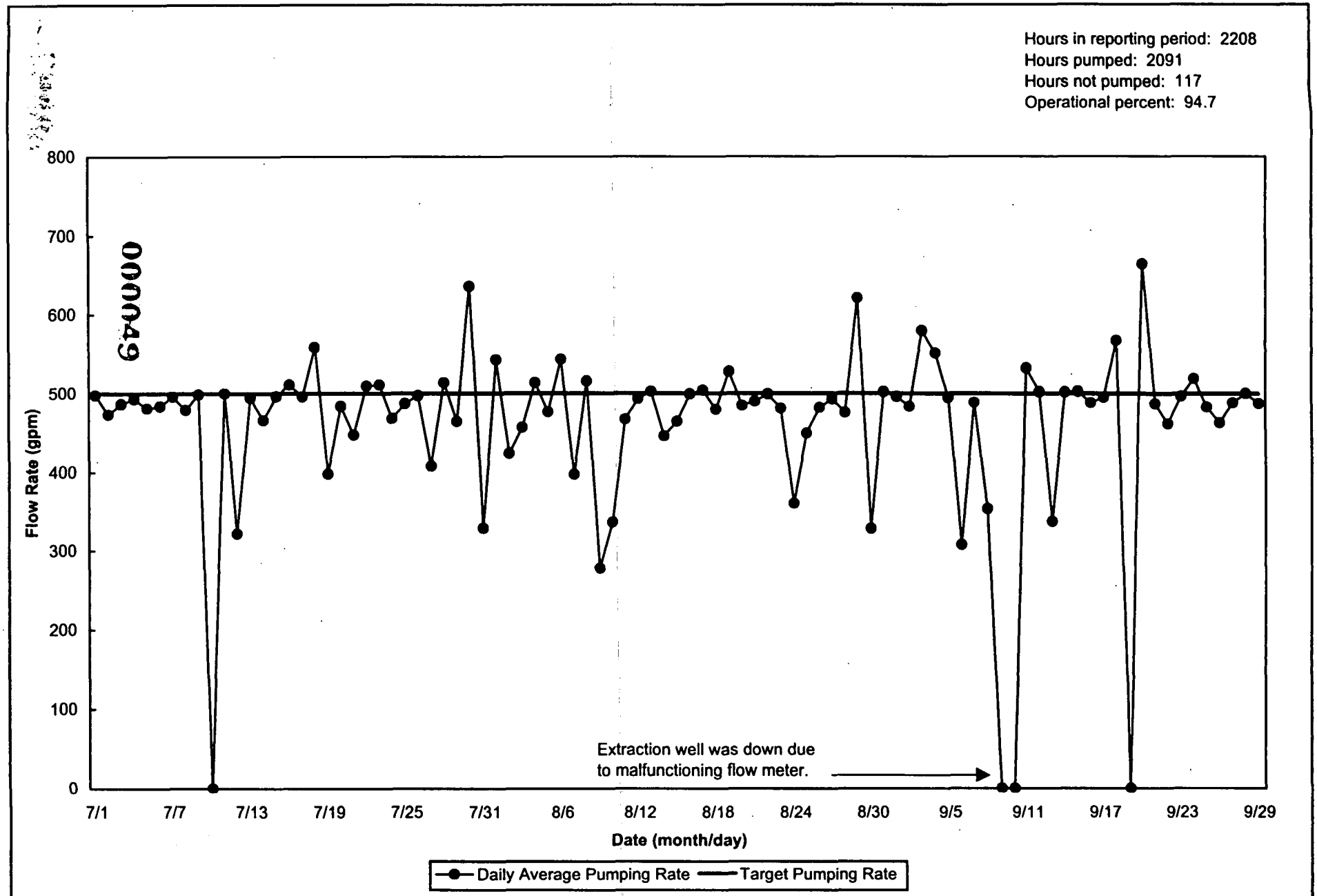


FIGURE 1-22. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3927, 7/00 - 9/00

FINAL

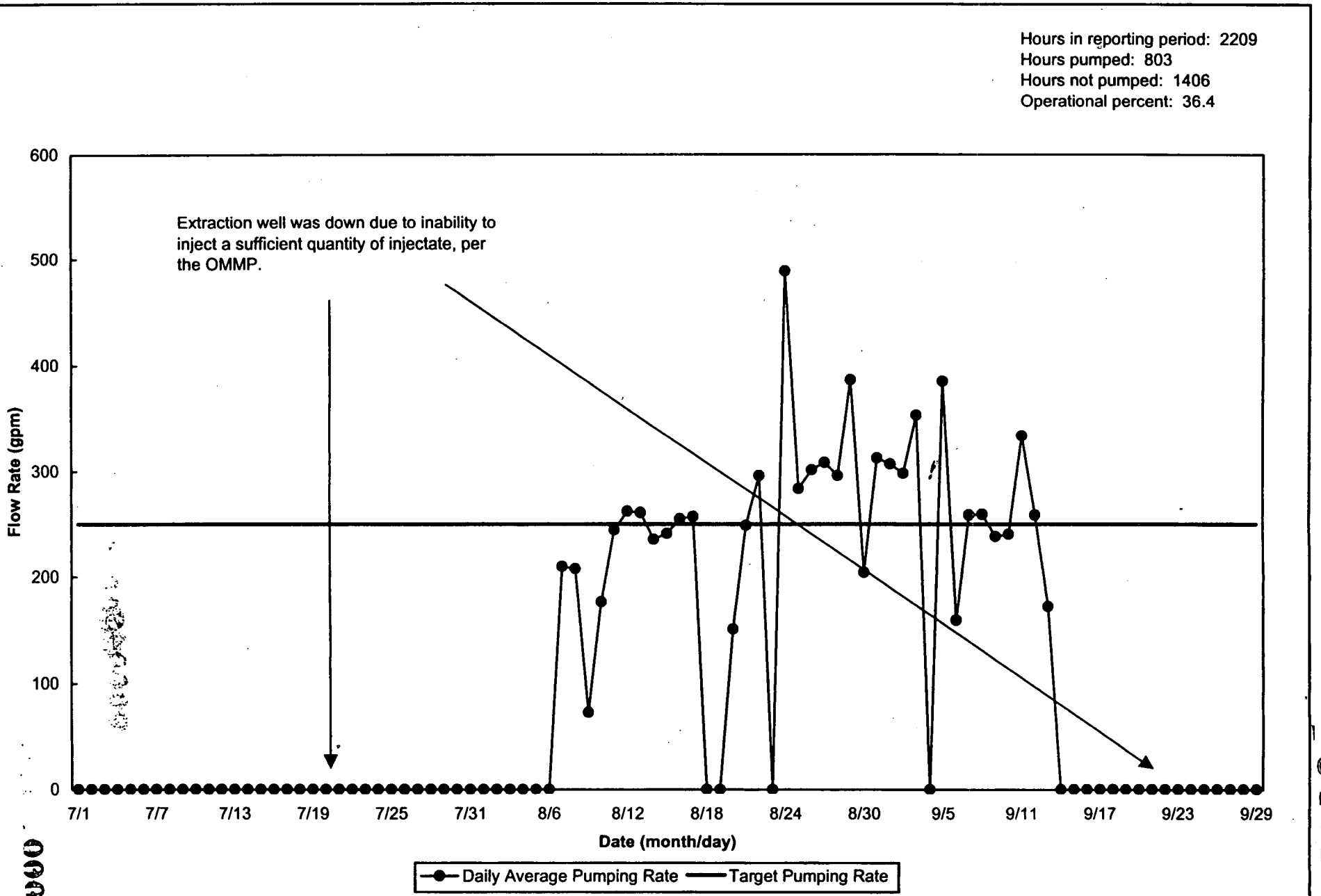


FIGURE 1-23. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32308, 7/00 - 9/00

FINAL

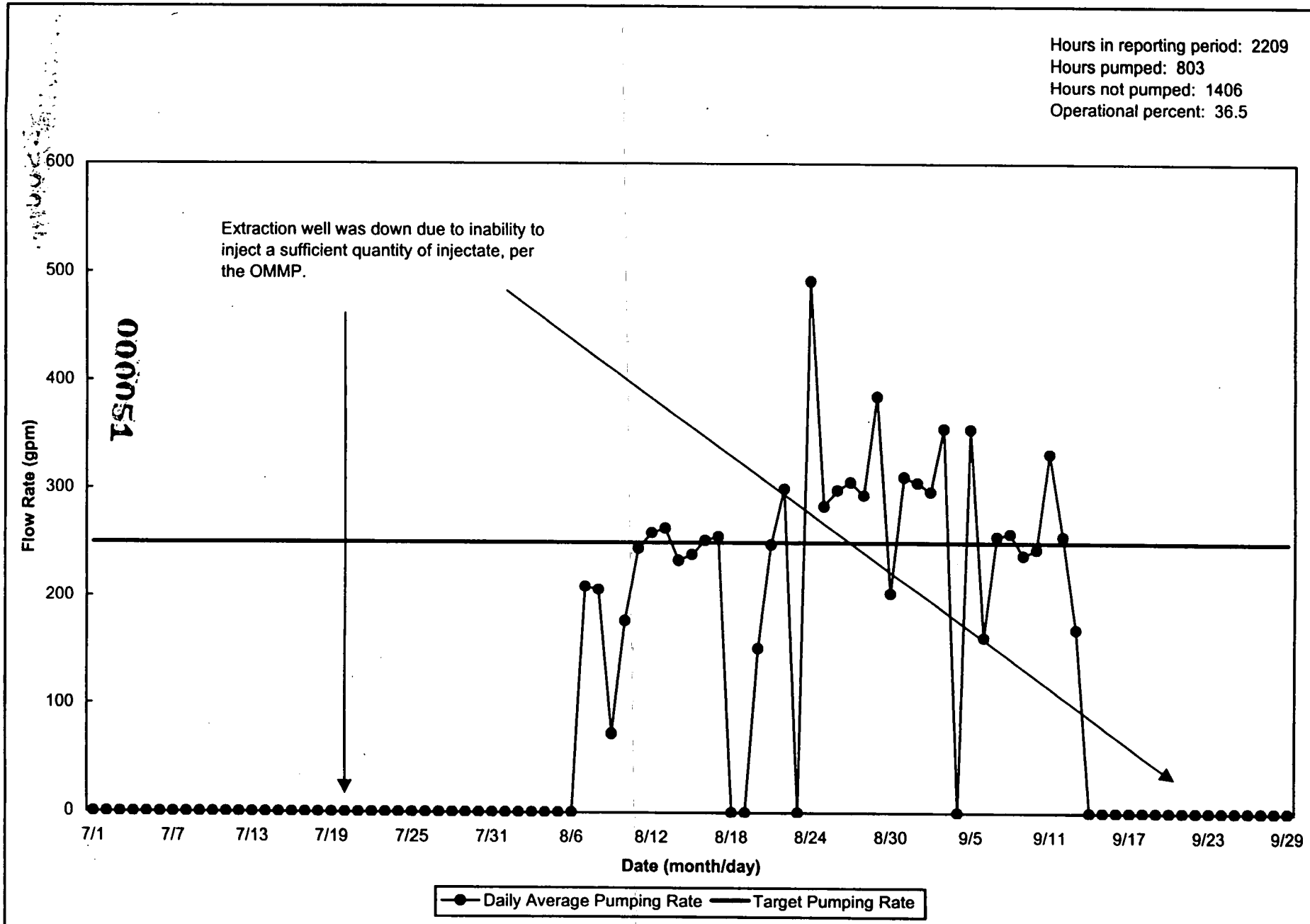
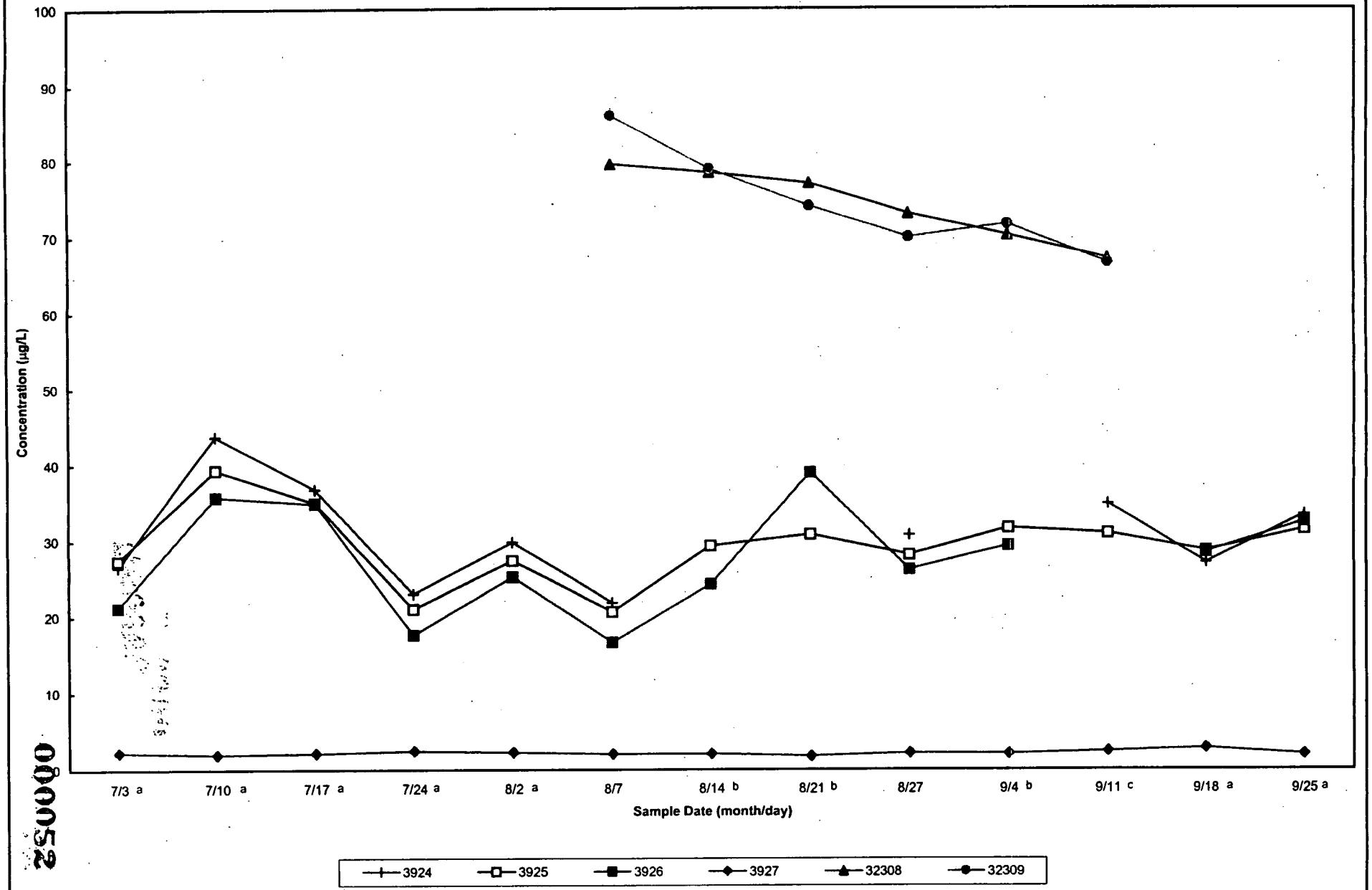


FIGURE 1-24. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32309, 7/00 - 9/00

FINAL



a Samples were not collected for Extraction Wells 32308 and 32309.

b A sample was not collected for Extraction Well 3924.

c A sample was not collected for Extraction Well 3926.

FINAL

FIGURE 1-25. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH PLUME MODULE

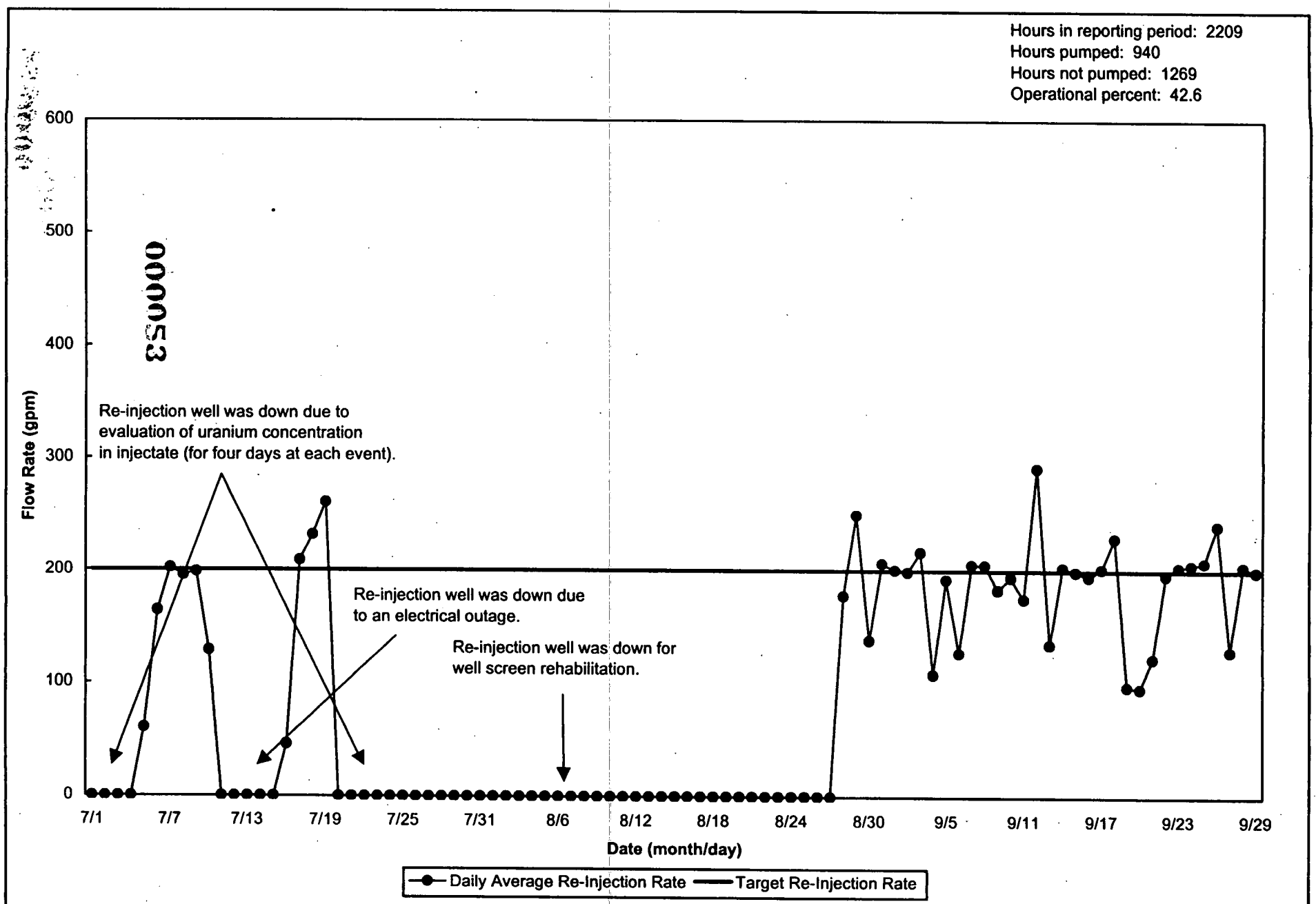


FIGURE 1-26. RE-INJECTION RATES FOR WELL 22107, 7/00 - 9/00

FINAL

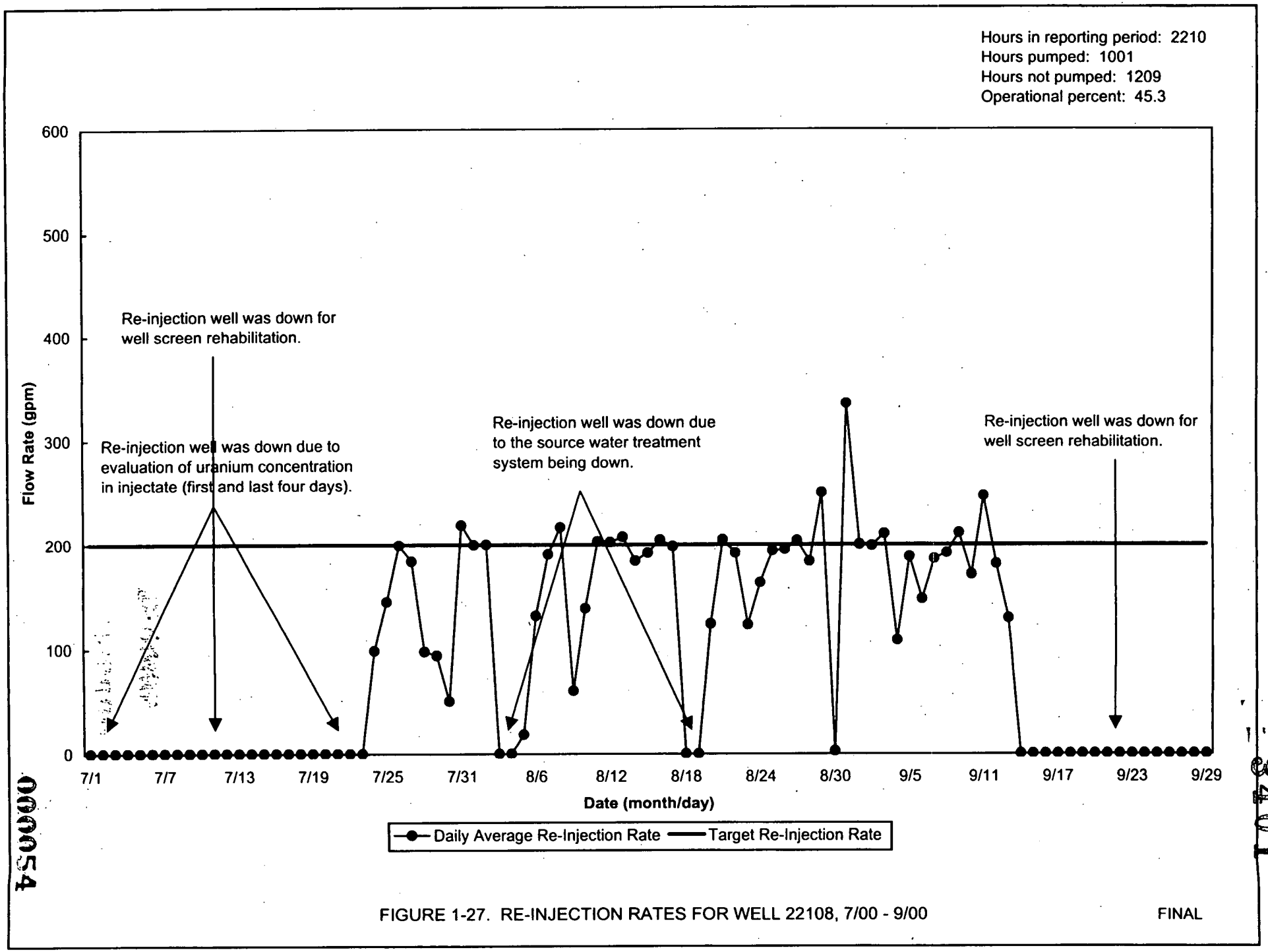


FIGURE 1-27. RE-INJECTION RATES FOR WELL 22108, 7/00 - 9/00

FINAL

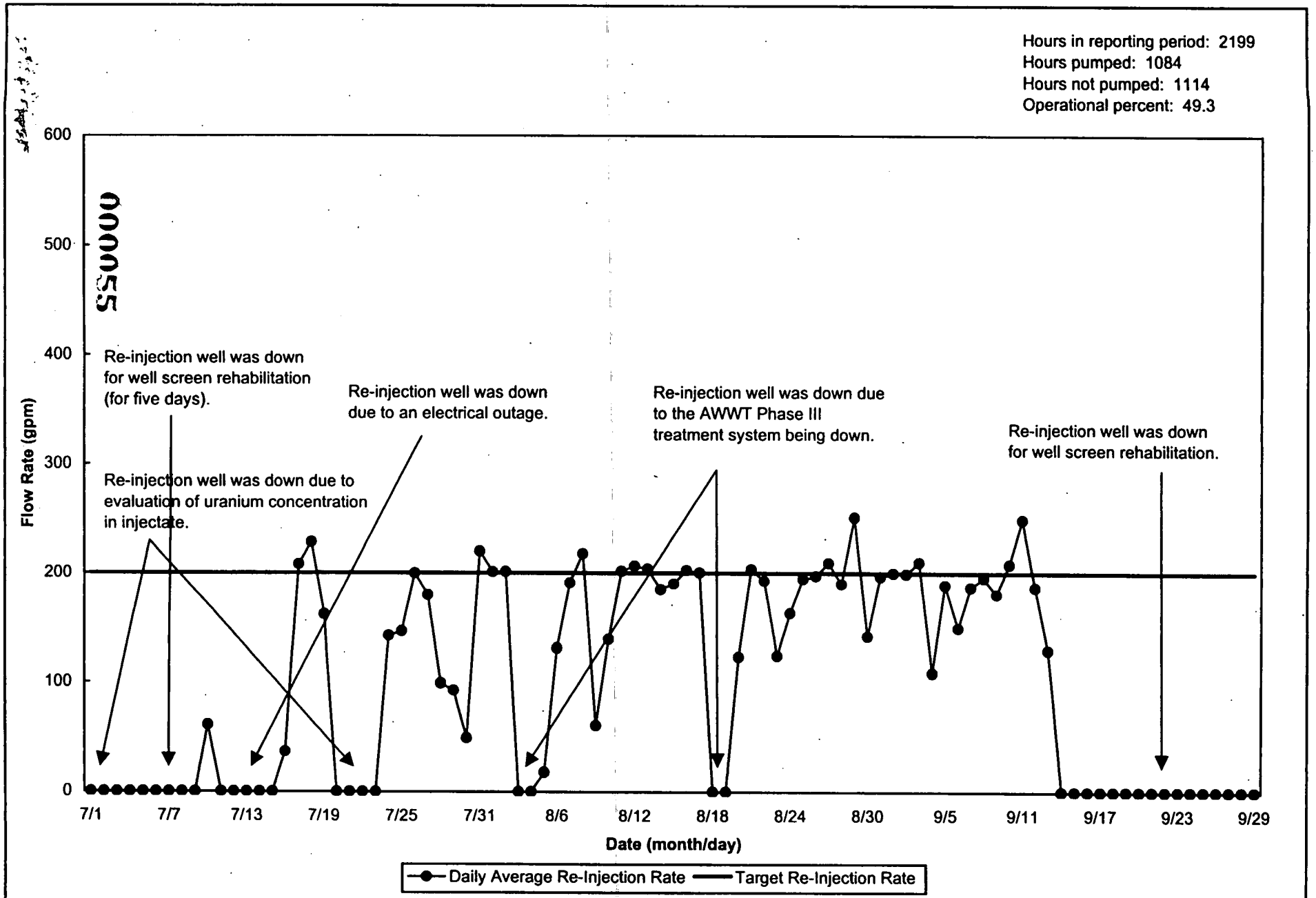


FIGURE 1-28. RE-INJECTION RATES FOR WELL 22109, 7/00 - 9/00

FINAL

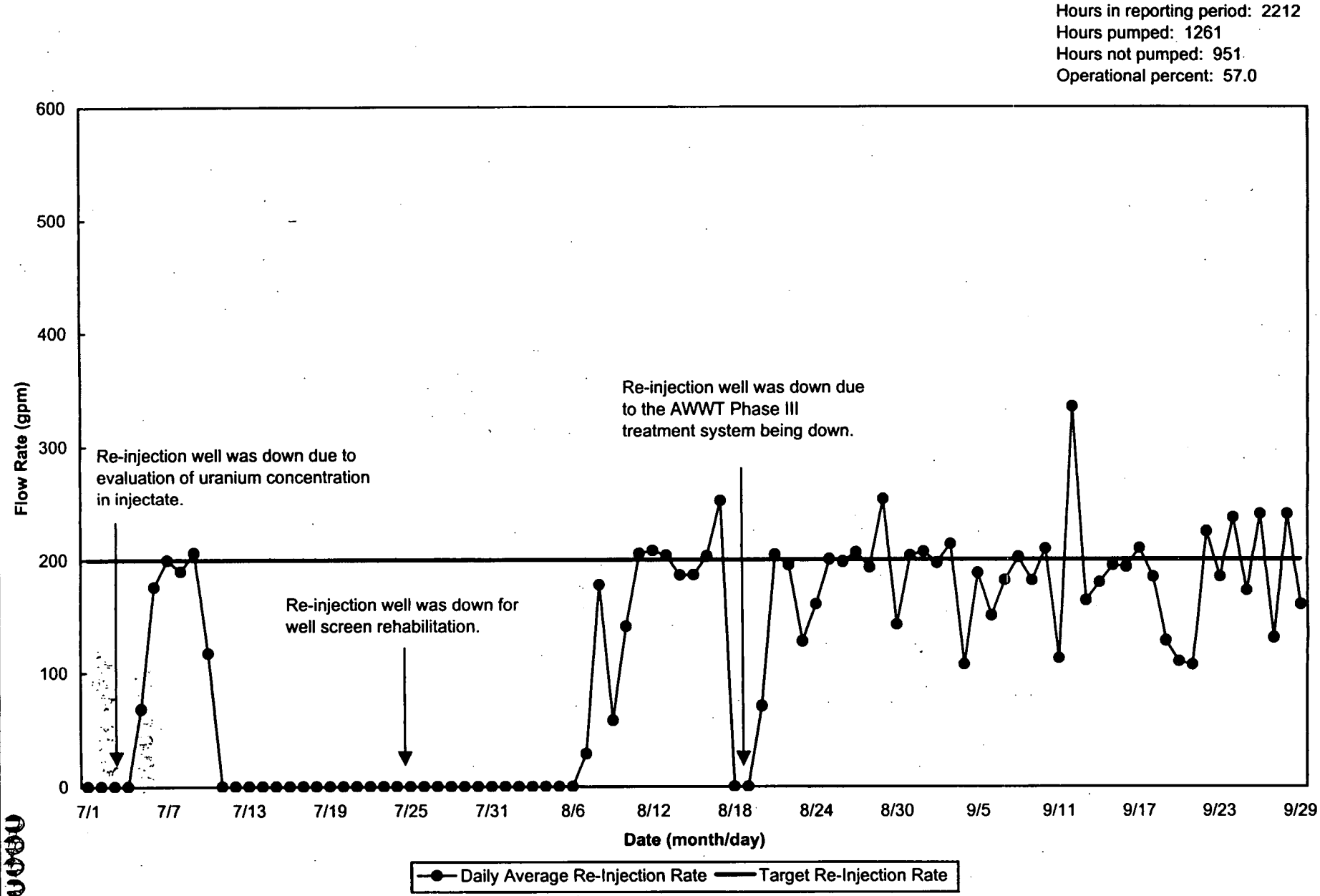


FIGURE 1-29. RE-INJECTION RATES FOR WELL 22111, 7/00 - 9/00

FINAL

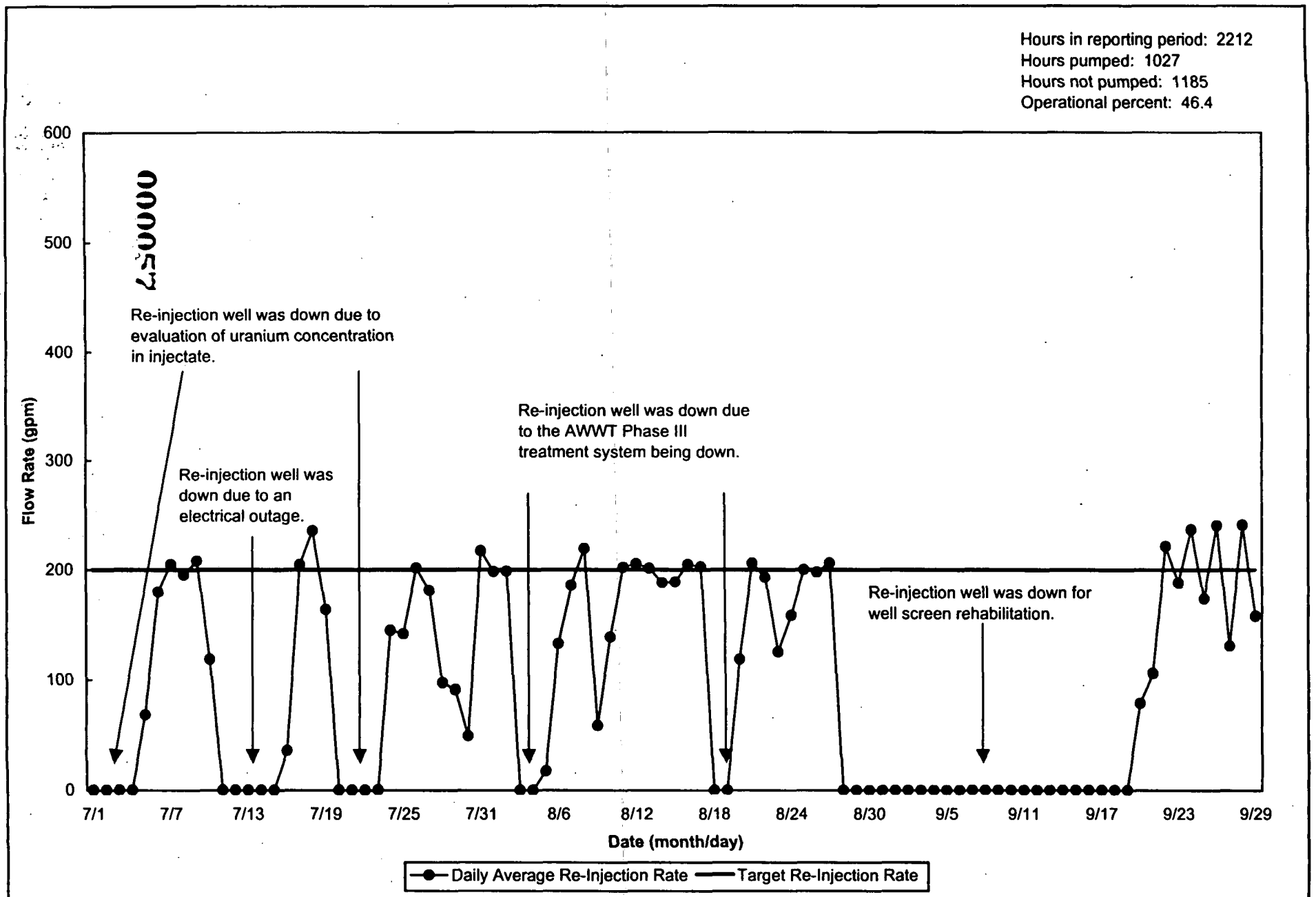
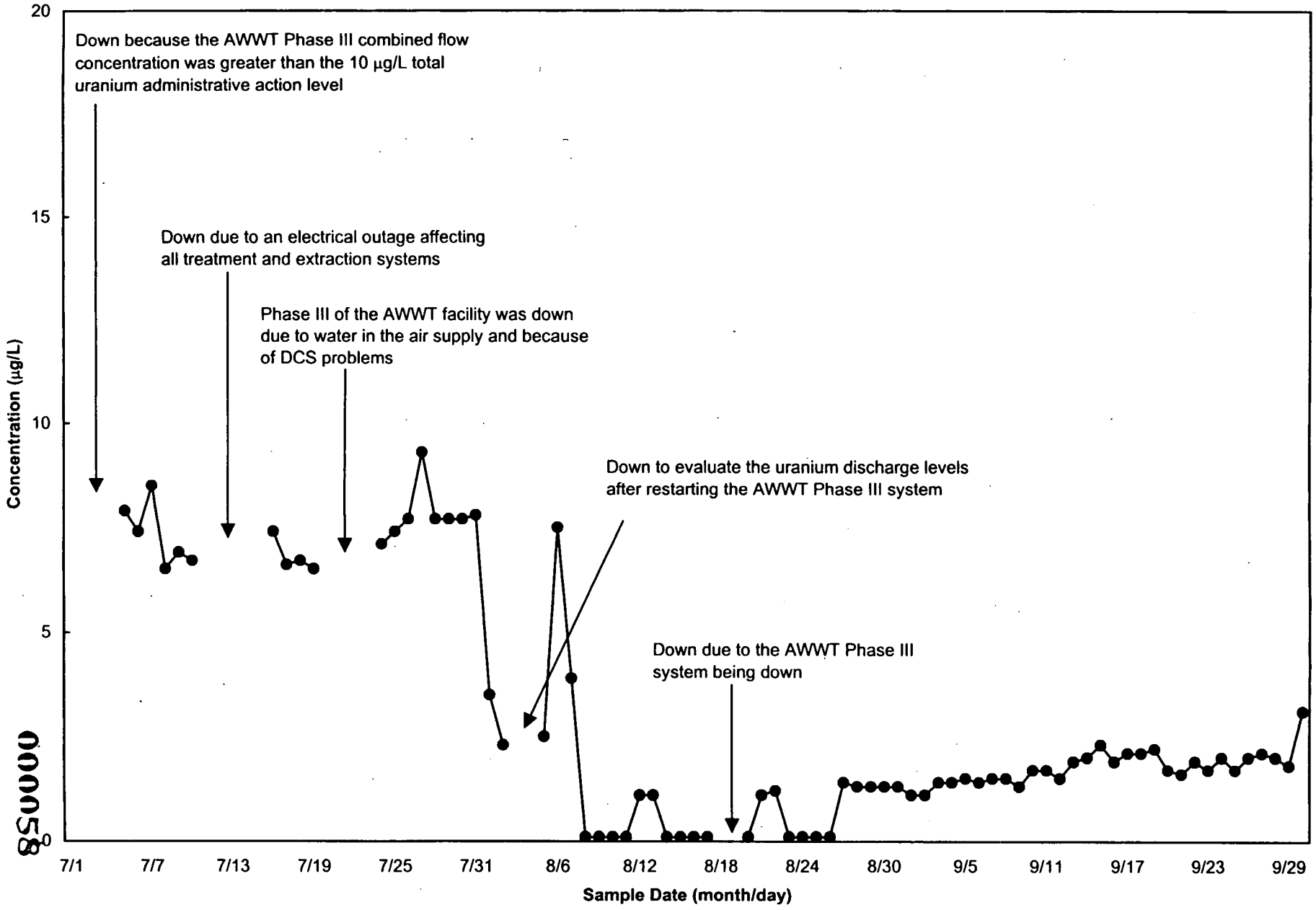


FIGURE 1-30. RE-INJECTION RATES FOR WELL 22240, 7/00 - 9/00

FINAL



Note: Total uranium concentration required to be less than 20 µg/L.

FIGURE 1-31. TOTAL URANIUM CONCENTRATIONS IN INJECTATE, 7/00 - 9/00

FINAL

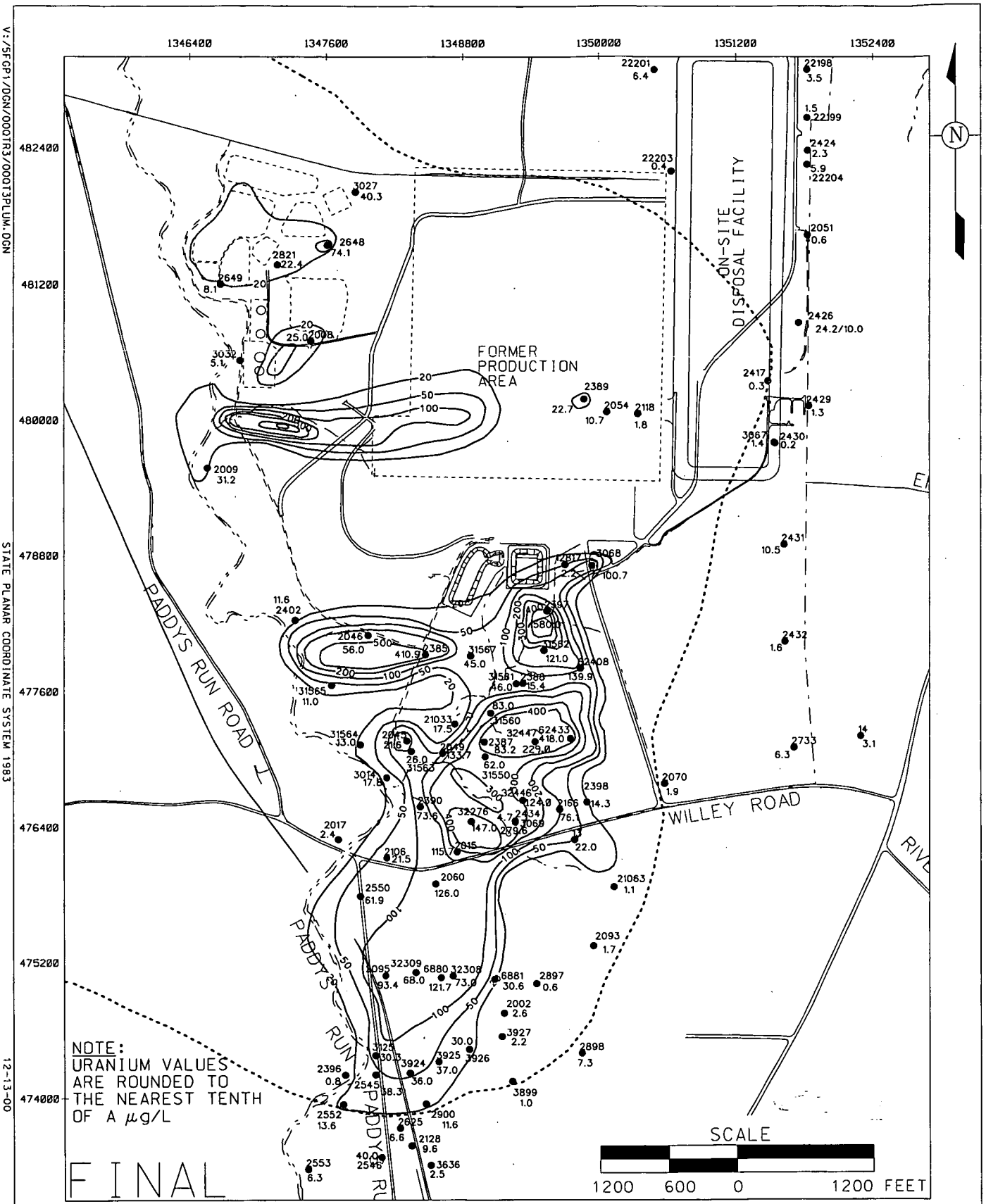
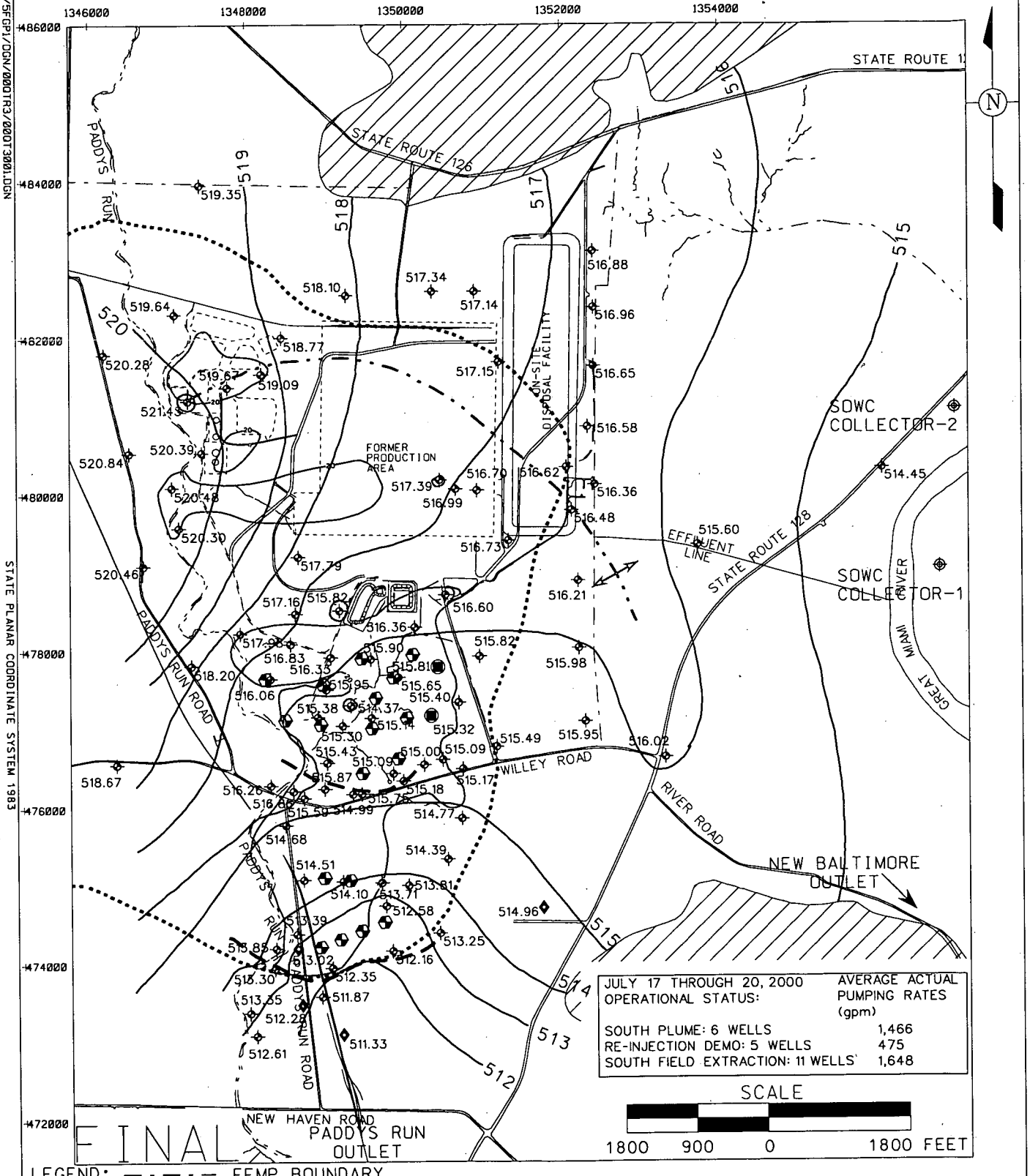


FIGURE 1-32. TOTAL URANIUM PLUME MAP, SECOND QUARTER 2000



LEGEND:

- FEMP BOUNDARY
- GROUNDWATER ELEVATION CONTOUR (FEET AMSL)
- CAPTURE ZONE
- BEDROCK HIGHS
- EXTRACTION WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- APPROXIMATE LOCATION OF GROUNDWATER FLOW DIVIDE
- 516.22 GROUNDWATER ELEVATION (FEET AMSL)
- EXTENT OF THE MAXIMUM TOTAL URANIUM 20 μg/L CONTOUR FROM BRSR, MODIFIED AS NEEDED THROUGH SECOND QUARTER 2000

V:\SFGPI\DGN\0001R3\0001T3001.DGN

STATE PLANAR COORDINATE SYSTEM 1983

12-13-00

FIGURE 1-33. ROUTINE GROUNDWATER ELEVATIONS FOR TYPE 2 WELLS, JULY 2000

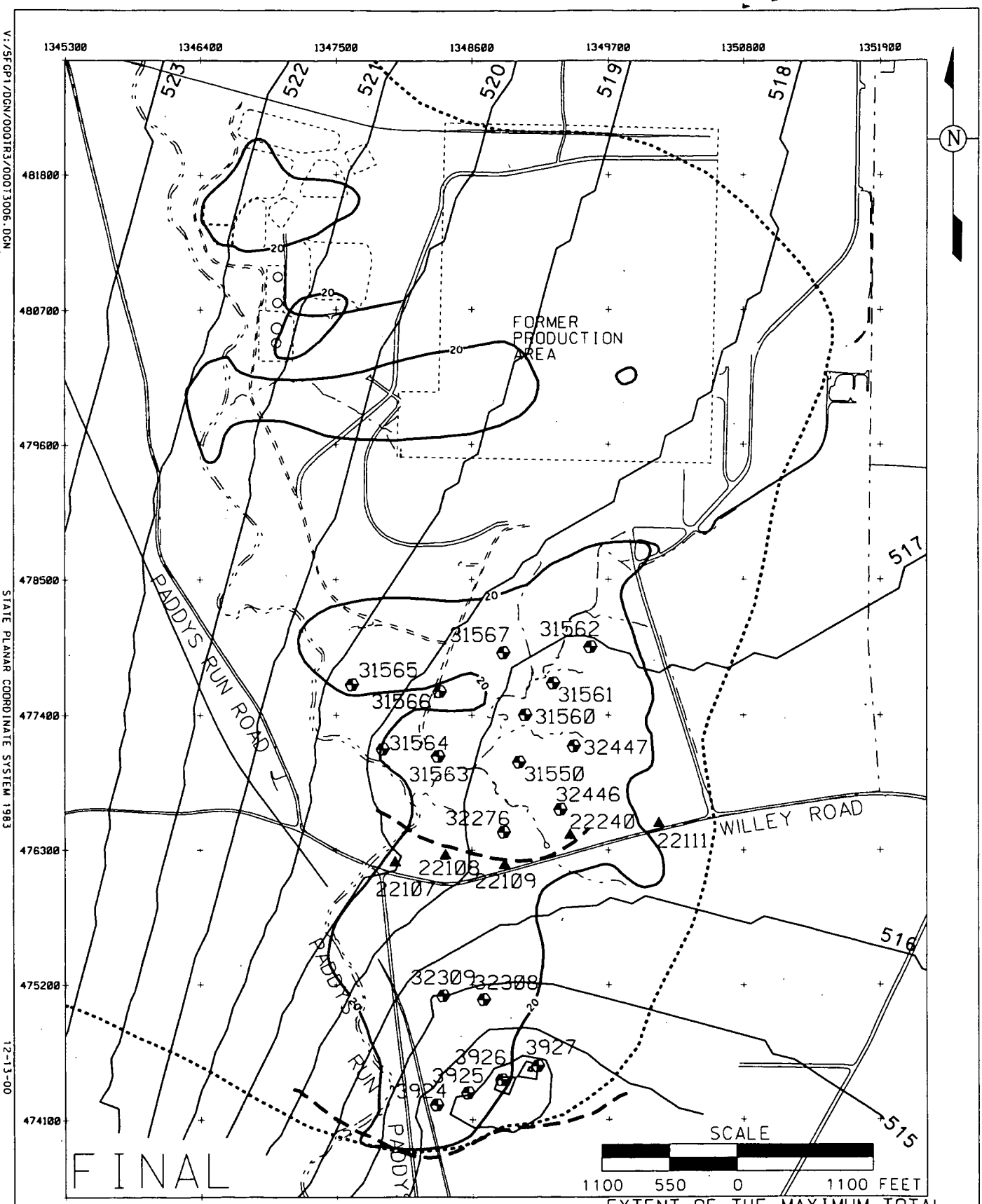


FIGURE 1-34. COMPARISON OF MODELED GROUNDWATER ELEVATIONS WITH INTERPRETED CAPTURE ZONES

On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring

2.0 ON-SITE DISPOSAL FACILITY GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING

This section summarizes the third quarter 2000 leachate collection system (LCS) and leak detection system (LDS) volume data and second quarter 2000 analytical results from the on-site disposal facility leak detection sampling activities. The material in this section satisfies the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a).

Figure 2-1 shows the sampling activities that contributed data to this section. Figure 2-2 identifies the well locations associated with the on-site disposal facility.

2.1 CELL 1

Placement of contaminated soil and debris in Cell 1 was completed during the third quarter. At the end of September, Cell 1 was 100 percent full.

2.1.1 CELL 1 LEAK DETECTION SYSTEM VOLUMES

The Cell 1 LDS primary containment vessel was pumped out once during the third quarter on August 14. This pumping resulted in a total of 112 gallons being removed from the Cell 1 LDS primary containment vessel for the quarter. The volume removed during the August 14 pump-out represents the volume that had accumulated since the last time the vessel was pumped out on January 25, 2000.

Figure 2-3 depicts quantitative weekly measurements of the LDS water accumulation rates along with summary statistics (minimum, maximum, and average) for the quarter. Figure 2-3 also provides the weekly precipitation amounts corresponding to each accumulation period. The precipitation data are included in an effort to determine if a correlation exists between precipitation and the LDS accumulation rate. Based on review of Figure 2-3, it does not appear that there is a correlation between precipitation and the Cell 1 LDS accumulation rates.

The accumulation rates for the third quarter ranged from 0.12 gallons per acre per day (gpad) to 0.34 gpad with an average of 0.20 gpad. The third quarter average is somewhat higher than the second quarter average of 0.04 gpad. The LDS accumulation rate at the end of the quarter was 0.34 gpad. This equates to a yield of about a little more than five cups of water per acre per day. The ongoing accumulation rate measurements indicate that the liner system for Cell 1 continues to perform such that the accumulation rates are far below (quarterly average is two orders of magnitude below) the on-site disposal facility design-established initial response leakage rate of 20 gpad.

2.1.2 CELL 1 ANALYTICAL STATUS

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan (DOE 1997b) and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the second quarter of 2000, the following samples were collected: one sample each of leachate (location 12338C) and LDS water (location 12338D); two baseline samples for perched groundwater (Horizontal Till Well 12338), and quarterly samples from the upgradient Great Miami Aquifer Monitoring Well 22201, and downgradient Great Miami Aquifer Monitoring Well 22198. Table 2-1 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-1 were detected during the reporting period (second quarter) in at least one of the four monitored horizons (i.e., LCS, LDS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
  - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point
  - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point
  - Row 2, Column 1, total number of samples with detections for the reporting period
  - Row 2, Column 2, range of results from the monitoring point for the reporting period.

The data in Table 2-1 generally indicate, as expected, progressively decreasing concentrations of the detected constituents from the LCS to the LDS to the horizontal till well. These decreasing concentrations, in conjunction with the very low LDS accumulation rate (approximately five cups per acre per day) indicate that the Cell 1 liner system is performing within the constraints established in the approved design.

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly and in IEMP annual integrated site environmental reports on updated control charts, once those charts are established in 2001.

2.2 CELL 2

Placement of contaminated soil and debris in Cell 2 continued during the third quarter. At the end of September, Cell 2 was approximately 51 percent full.

2.2.1 CELL 2 LEAK DETECTION SYSTEM VOLUMES

Volumes pumped from the Cell 2 LDS for the third quarter of 2000 are as follows: July (300.4 gallons); August (194.4 gallons); and September (96.7 gallons).

Figure 2-4 depicts quantitative weekly measurements of the LDS water accumulation rates along with summary statistics (minimum, maximum, and average) for the quarter. Figure 2-4 also provides the weekly precipitation amounts corresponding to each accumulation period. The precipitation data are included in an effort to determine if a correlation exists between precipitation and the LDS accumulation rate.

Based on review of Figure 2-4, there does not appear to be a strong correlation of precipitation and the Cell 2 LDS accumulation rates during the third quarter. Also, the increasing accumulation rates reported in the Integrated Environmental Monitoring Status Report for Second Quarter 2000 (DOE 2000d) appear to have reversed to a relatively steady decline during the third quarter. The accumulation rates for the third quarter ranged from 0.13 to 1.92 gpad with an average of 0.66 gpad. The third quarter average is about 59 percent of the second quarter average of 1.12 gpad. The ongoing accumulation rate measurements indicate that the liner system for Cell 2 continues to perform such that the accumulation rates are far below the on-site disposal facility design-established initial response leakage rate of 20 gpad (quarterly average is about three percent of the initial response rate).

2.2.2 CELL 2 ANALYTICAL STATUS

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the second quarter of 2000, the following samples were collected: one sample each of leachate (location 12339C) and LDS water (location 12339D); two baseline sampling events for perched groundwater (Horizontal Till Well 12339), and quarterly samples from upgradient Great Miami Aquifer Monitoring Well 22200, and downgradient Great Miami Aquifer Monitoring Well 22199. Table 2-2 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-2 were detected during the reporting period (second quarter) in at least one of the four monitored horizons (i.e., LCS, LDS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
  - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point
  - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point
  - Row 2, Column 1, total number of samples with detections for the reporting period
  - Row 2, Column 2, range of results from the monitoring point for the reporting period.

Note that the LDS total organic carbon and boron concentrations are still greater than those found in the LCS sample for the quarter. This indicates that the residual contamination from the leachate water that backed up in the system in December of 1998 continues to confound the interpretation of the LDS analytical data. Also of note are the decreases in total organic carbon, boron, and total uranium concentrations when comparing the LDS results to the horizontal till well results for the quarter. These decreasing concentrations in conjunction with the third quarter 2000 LDS accumulation rates indicate that the Cell 2 liner system is performing within the constraints established in the approved design.

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly and in IEMP annual integrated site environmental reports.

2.3 CELL 3

Placement of contaminated soil and debris in Cell 3 continued during the third quarter. At the end of September, Cell 3 was approximately 24 percent full.

2.3.1 CELL 3 LEAK DETECTION SYSTEM VOLUMES

No water accumulated in the Cell 3 LDS primary containment vessel during the third quarter of 2000; therefore, the water accumulation rate for the entire quarter is zero.

2.3.2 CELL 3 ANALYTICAL STATUS

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the second quarter of 2000, the following samples were collected: one sample of leachate (location 12340C); two baseline sampling events for perched groundwater (Horizontal Till Well 12340), and quarterly samples from the upgradient Great Miami Aquifer Monitoring Well 22203, and downgradient Great Miami Aquifer Monitoring Well 22204. The Cell 3 LDS (location 12338D) did not yield any water; therefore, a LDS sample was not collected. Table 2-3 provides detected results for the quarter along with a summary of previous data for thosc constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-3 were detected during the reporting period (second quarter) in at least one of the four monitored horizons (i.e., LCS, LDS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
  - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point
  - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point
  - Row 2, Column 1, total number of samples with detections for the reporting period
  - Row 2, Column 2, range of results from the monitoring point for the reporting period.

The data in Table 2-3 generally indicate, as expected, decreasing concentrations of the detected constituents from the LCS to the horizontal till well. These decreasing concentrations, in conjunction with the lack of water yield in the Cell 3 LDS indicate that the Cell 3 liner system is performing within the constraints established in the approved design.

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS (if the LDS yields water) and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly and in IEMP annual integrated site environmental reports on updated control charts, once those charts are established in 2001.

2.4 CELL 4

2.4.1 CELL 4 ANALYTICAL STATUS

Baseline sampling of Monitoring Wells 2421 and 22205 has been postponed until the spring or summer of 2001 due to the delay in the Cell 4 construction schedule.

2.5 LEACHATE COLLECTION SYSTEM VOLUMES

Volumes from the LCS for the third quarter of 2000 are as follows: July (470,655 gallons); August (659,801gallons); and September (782,684 gallons).

TABLE 2-1

ON-SITE DISPOSAL FACILITY CELL 1 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING SECOND QUARTER 2000

Note: Non-italicized pertains to total number of samples (including second quarter samples).
Italicized pertains to second quarter samples only.

Constituent (FRL)[a]	LCS[b,c,d,e] (12338C)		LDS[b,c,d,e] (12338D)		HTW[b,c,d,e] (12338)		Great Miami Aquifer: Upgradient[b,c,d] (22201)		Great Miami Aquifer: Downgradient[b,c,d] (22198)	
	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range
Total Organic Carbon (NA[f] mg/L)	8/10	ND to 123	7/9	ND to 80.9	26/29	ND to 12.2	22/25	ND to 59.7	21/25	ND to 52.5
	1/1	*21.8*	*1/1*	*3.29*	*1/2*	*ND to 1.51*	*1/1*	*2.16*	*1/1*	*1.89*
Total Organic Halogens (NA[f] mg/L)	8/10	ND to 0.23	7/9	ND to 0.361	16/28	ND to 0.077	13/25	ND to 0.308	8/25	ND to 0.0526
	1/1	*0.23*	*1/1*	*0.361*	*1/2*	*ND to 0.00748*	*1/1*	*0.308*	*0/1*	*ND*
Boron (0.33 mg/L)	11/11	0.0642 to 2.8	9/9	0.0296 to 0.321	23/29	ND to 0.685	20/25	ND to 0.142	27/36	ND to 0.116
	1/1	*1.02*	*1/1*	*0.243*	*2/2*	*0.116 to 0.123*	*1/1*	*0.0913*	*1/2*	*ND to 0.0501*
Technetium-99 (94.0 pCi/L)	4/10	ND to 18.28	1/9	ND to 8.92	7/30	ND to 21.1	1/25	ND to 13.41	2/36	ND to 14.8
	1/1	*10.05*	*0/1*	*ND*	*0/2*	*ND*	*0/1*	*ND*	*0/2*	*ND*
Total Uranium (20 µg/L)	9/10	ND to 119	9/9	1.5 to 20.17	29/30	ND to 19	21/25	ND to 6.384	36/36	0.557 to 3.814
	1/1	*77.644*	*1/1*	*8.695*	*2/2*	*1.521 to 1.923*	*1/1*	*6.384*	*2/2*	*1.227 to 3.509*

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]If there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.
[c]Rejected data qualified with either a R or Z were not used in this comparison.
[d]ND = not detected
[e]LCS = leachate collection system
LDS = leak detection system
HTW = horizontal till well
[f]NA = not applicable

TABLE 2-2

ON-SITE DISPOSAL FACILITY CELL 2 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING SECOND QUARTER 2000

Note: Non-italicized pertains to total number of samples (including second quarter samples).
Italicized pertains to second quarter samples only.

Constituent (FRL)[a]	LCS[b,c,d,e] (12339C)		LDS[b,c,d,e,f] (12339D)		HTW[b,c,d,e] (12339)		Great Miami Aquifer: Upgradient[b,c,d] (22200)		Great Miami Aquifer: Downgradient[b,c,d] (22199)	
	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range
Total Organic Carbon (NA[g] mg/L)	4/7	ND to 6.25	7/8	ND to 26.1	22/27	ND to 11.1	18/20	ND to 47.6	16/20	ND to 51.8
	0/1	*ND*	*1/1*	*3.91*	*1/2*	*ND to 1.37*	*1/1*	*1.06*	*1/1*	*1.23*
Total Organic Halogens (NA[g] mg/L)	4/7	ND to 0.0576	4/8	ND to 0.0205	18/27	ND to 0.101	10/20	ND to 0.177	9/20	ND to 0.0386
	1/1	*0.0576*	*0/1*	*ND*	*2/2*	*0.03496 to 0.037*	*1/1*	*0.177*	*0/1*	*ND*
Boron (0.33 mg/L)	7/8	ND to 0.915	7/7	0.396 to 2.22	16/27	ND to 0.0829	14/20	ND to 0.158	14/20	ND to 0.0569
	1/1	*0.421*	*1/1*	*0.497*	*1/2*	*ND to 0.045*	*1/1*	*0.046*	*1/1*	*0.042*
Total Uranium (20 µg/L)	8/8	4.51 to 39.299	7/7	12 to 71	27/28	ND to 3.607	13/20	ND to 1.11	20/20	0.259 to 12.1
	1/1	*39.299*	*1/1*	*20.749*	*2/2*	*2.633 to 3.351*	*0/1*	*ND*	*1/1*	*1.45*

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]If there was more than one sample result per day (e.g, a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.
[c]Rejected data qualified with either a R or Z were not used in this comparison.
[d]ND = not detected
[e]LCS = leachate collection system
LDS = leak detection system
HTW = horizontal till well
[f]Cell 2 LDS data from December 1998 to present are suspect due to a December 1998/January 1999 back-up of leachate from the leachate transmission system line into the Cell 2 LDS layer and the resultant residual contamination of the LDS layer from the back-up
[g]NA = not applicable

TABLE 2-3

ON-SITE DISPOSAL FACILITY CELL 3 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING SECOND QUARTER 2000

Note: Non-italicized pertains to total number of samples (including second quarter samples).
Italicized pertains to second quarter samples only.

	LCS (12340C)		HTW[b,c,d,e] (12340)		Great Miami Aquifer			
					Upgradient[b,c,d] (22203)		Downgradient[b,c,d] (22204)	
Constituent (FRL)[a]	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range
Total Organic Carbon (NA[f] mg/L)	2/4	ND to 34.2	13/23	ND to 9.81	7/18	ND to 5.66	8/18	ND to 8.83
	0/1	*ND*	*2/2*	*1.368 to 2.09*	*1/1*	*0.89*	*1/1*	*1.24*
Total Organic Halogens (NA[f] mg/L)	3/4	ND to 0.178	18/23	ND to 0.158	9/18	ND to 0.213	8/18	ND to 0.165
	1/1	*0.0383*	*2/2*	*0.0205 to 0.02064*	*1/1*	*0.213*	*1/1*	*0.165*
Boron (0.33 mg/L)	4/4	0.268 to 1.51	18/22	ND to 0.24	12/18	ND to 0.0776	11/18	ND to 0.179
	1/1	*1.51*	*1/2*	*ND to 0.163*	*1/1*	*0.0379*	*1/1*	*0.0406*
Technetium-99 (94.0 pCi/L)	0/4	ND to ND	2/22	ND to 38.35	1/18	ND to 8.438	0/18	ND to ND
	0/1	*ND*	*0/2*	*ND*	*1/1*	*8.438*	*0/1*	*ND*
Total Uranium (20 µg/L)	4/4	9.27 to 34.997	20/22	ND to 9.14	13/18	ND to 0.907	17/18	ND to 5.924
	1/1	*34.997*	*2/2*	*8.142 to 8.305*	*1/1*	*0.401*	*1/1*	*5.924*

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]If there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.
[c]Rejected data qualified with either a R or Z were not used in this comparison.
[d]ND = not detected
[e]HTW = horizontal till well
[f]NA = not applicable

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FIGURE 2-1

ON-SITE DISPOSAL FACILITY LEAK DETECTION ACTIVITIES[a]

LEAK DETECTION ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cell 1												
LDS Volumes							◆	◆	◆			
Analytical				◆	●	◆						
Cell 2												
LDS Volumes							◆	◆	◆			
Analytical				◆	◆	◆						
Cell 3												
LDS Volumes							◆	◆	◆			
Analytical				◆	◆	●						
LCS Volumes							◆	◆	◆			

◆ Data summarized/evaluated in this report

FINAL

[a]Future data will be reported through the IEMP Extranet Site and quarterly summaries.

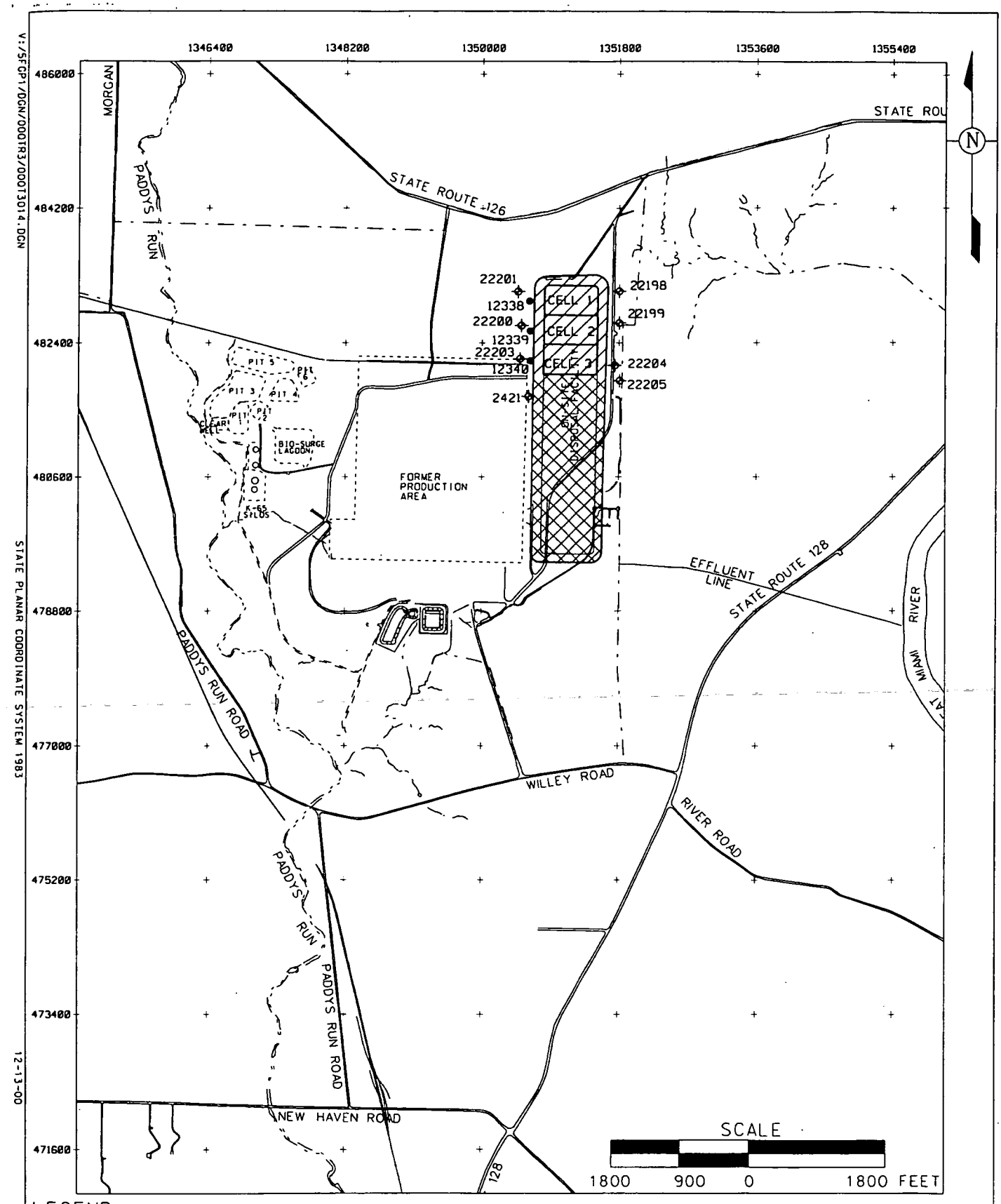

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FIGURE 2-2. ON-SITE DISPOSAL FACILITY FOOTPRINT AND MONITORING WELL LOCATIONS

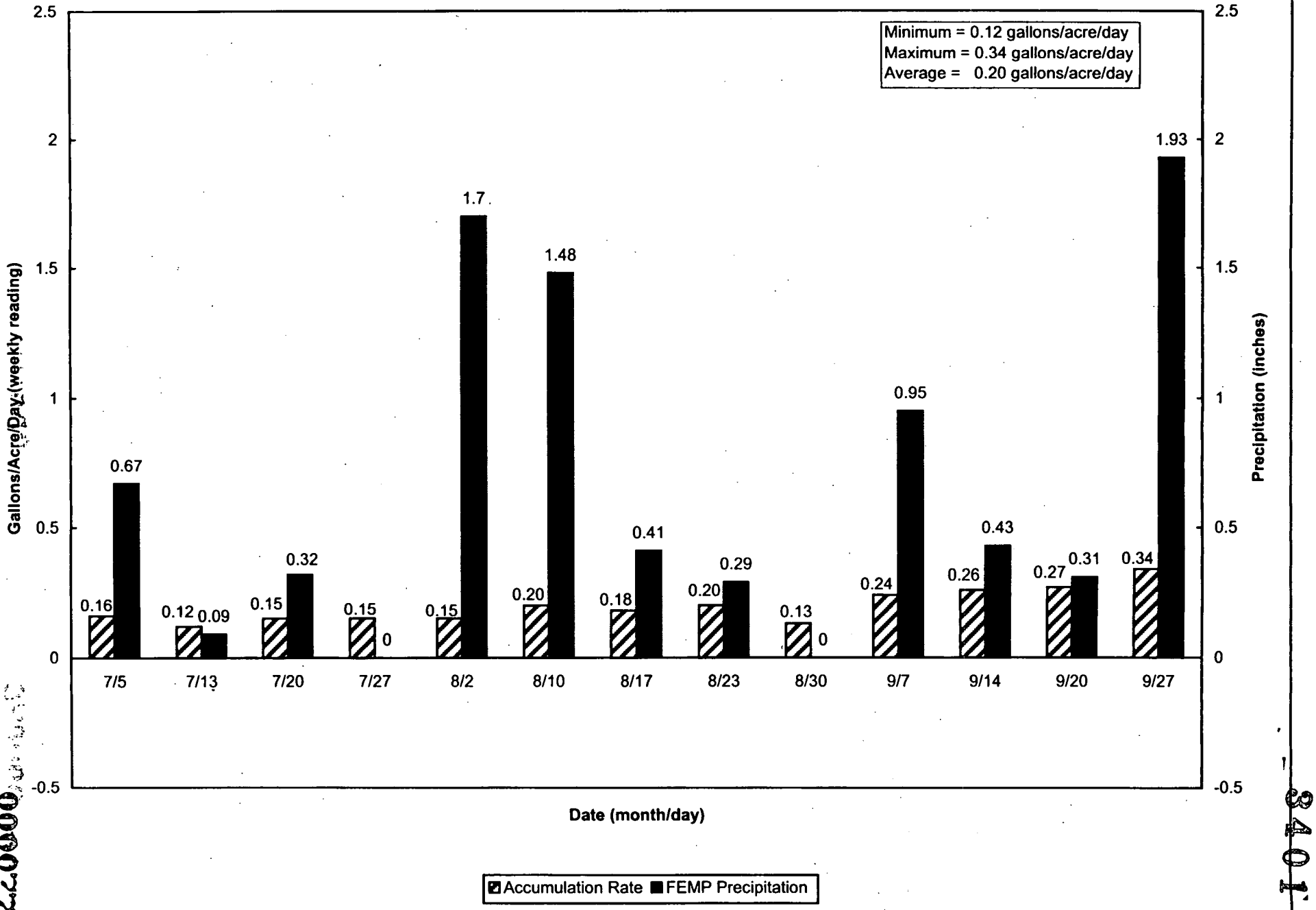


FIGURE 2-3. ON-SITE DISPOSAL FACILITY LDS ACCUMULATION RATES FOR CELL 1

FINAL

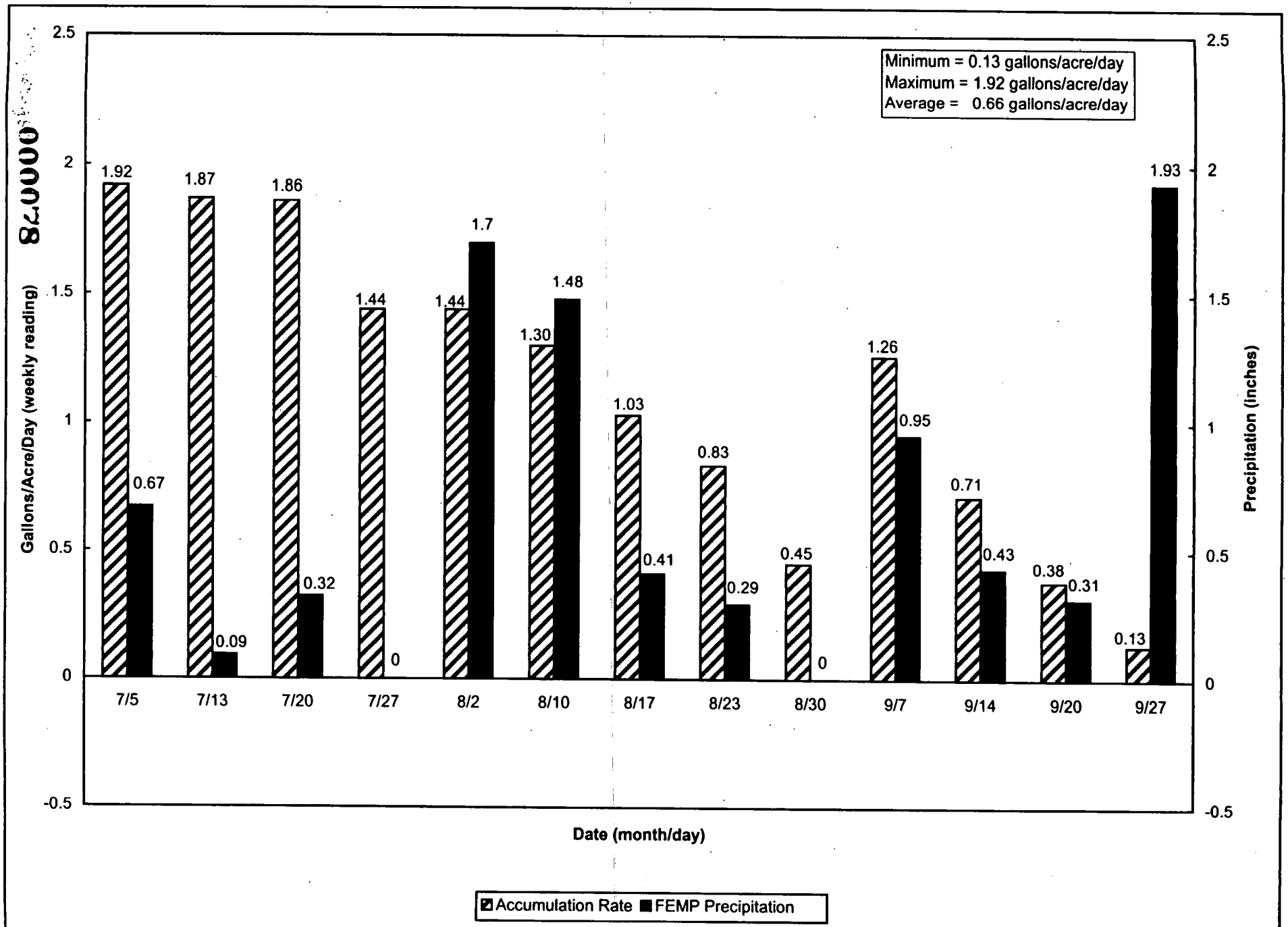


FIGURE 2-4. ON-SITE DISPOSAL FACILITY LDS ACCUMULATION RATES FOR CELL 2

FINAL

Surface Water and Treated Effluent

3.0 SURFACE WATER AND TREATED EFFLUENT

This section provides a status of the surface water and treated effluent monitoring for the third quarter of 2000. Figure 3-1 shows the data included in this section. Figure 3-2 identifies the surface water and treated effluent sample locations. Analytical results from the following routine monitoring program elements were utilized to complete the reporting requirements identified in Section 4.6.2 of the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a):

- National Pollutant Discharge Elimination System (NPDES) permit (data obtained from July through September 2000)
- Federal Facilities Compliance Agreement (FFCA) requirements (data obtained from July through September 2000)
- IEMP Characterization Program results (data obtained from April through June 2000).

3.1 NPDES PERMIT COMPLIANCE

Figure 3-3 identifies the surface water and treated effluent sample locations associated with NPDES compliance monitoring. There were no noncompliances experienced during the third quarter of 2000.

3.2 FFCA AND OU5 ROD COMPLIANCE

Figure 3-4 shows that a cumulative total of 182.8 pounds of uranium were discharged to the Great Miami River in effluent from January through September 2000. The Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996) established an annual discharge limit to the Great Miami River of 600 pounds for total uranium.

Uncontrolled runoff also contributes to the amount of total uranium entering the environment. A loading term has been established to estimate the amount of uranium discharged through uncontrolled runoff based on the amount of rainfall measured. The loading term used is 2.6 pounds of uranium discharged per inch of rainfall. Figure 6-1 shows that precipitation during the third quarter of 2000 was 8.62 inches; therefore, the mass of total uranium discharged to Paddys Run through uncontrolled runoff from July through September 2000 is estimated to be 22.41 pounds.

Figure 3-5 illustrates that the monthly average total uranium concentration limit of 20 micrograms per liter for water discharged to the Great Miami River was met each month during the third quarter of 2000. There were no changes to Table 3-1 because no treatment plant maintenance or significant precipitation bypass events occurred during the third quarter of 2000.

Figure 3-6 presents controlled and uncontrolled surface water flow areas for the third quarter of 2000. As identified in previous IEMP quarterly status reports, an evaluation is to occur at least quarterly to ensure that the appropriate areas are being controlled. There were no changes from that depicted in the Integrated Environmental Monitoring Status Report for Second Quarter 2000 (DOE 2000d).

3.3 SURVEILLANCE MONITORING

The following activities occurred during the third quarter of 2000 that could have potentially impacted the water quality at various surface water sample locations (identified in parentheses):

- Limited activities in the on-site disposal facility borrow area (SWD-02 and STRM 4003)
- Waste placement activities associated with on-site disposal facility Cells 2 and 3 and placement of select material in Cell 1 (PF 4001)
- Completed activities associated with the remaining lead contaminated soil in the trap range in Area 1, Phase II (SWD-02 and STRM 4003)
- Began construction of the on-site disposal facility material transfer area bulk debris staging area (PF 4001)
- Began construction of the Laydown Area, Access Road Project (STRM 4006)
- Completed excavation activities associated with Soil Pile 3 (STRM 4003)
- Initiated excavation of the Area 2, Phase I "Carolina Area" (STRM 4003)
- Excavation of southern waste unit material and hauling of excavated materials to the on-site disposal facility via the impacted material haul road (STRM 4004, STRM 4005, and PF 4001)
- Began removal of Area 2, Phase I Storm Water Basin 3 and construction of Storm Water Basin 4 (PF 4001, STRM 4003, and STRM 4004)
- Continuation of full scale operations at the Waste Pits Remedial Action Project (WPRAP) including excavation, processing, and drying of waste pit material and other general support activities (PF 4001, SWD-03, and STRM 4005)
- Loading of contaminated material in support of WPRAP activities (STRM 4005, PF 4001, and SWD-03)
- Rail yard activities in support of the loading and shipping of railcars (STRM 4006 and SWP-02)
- Continued site preparation activities associated with the Operable Unit 4 Accelerated Waste Retrieval and Silo 3 Stabilization Projects including the installation of various pads and foundations (SWD-03 and STRM 4005).

All required samples from the surface water and treated effluent locations were collected during the second and third quarters. Based on a review of the surface water data associated with this report (Figure 3-1), there was one final remediation level (FRL) exceedance (Table 3-2). On April 4, 2000, the only exceedance occurred for silver at IEMP monitoring point SWD-03. The result of 0.0106 milligrams per liter (mg/L) was above the established FRL of 0.005 mg/L (there is also a benchmark toxicity value established for silver of 0.0013 mg/L). This is the first exceedance

of silver at this location. A definitive cause has not been established. There was no discharge of storm water from the WPRAP Storm Water Management Pond to Paddys Run on this day and no unusual occurrences logged in the Assistant Emergency Duty Officer's daily log that may have contributed to this exceedance. The FEMP received 1.62 inches of rain over a four-day period beginning April 1, 2000; however, only 0.08 inches of rain was recorded on April 4, 2000. Construction activity was occurring in the area of the silos but silver is not a contaminant of concern within this drainage area (Area 7). Monitoring at this location will continue and results reported through the IEMP.

It must be noted that a mercury result from a sample collected at the Parshall Flume (PF 4001) on April 5, 2000 was reported at 0.00022 mg/L which is slightly above the mercury FRL of 0.0002 mg/L. The result was qualified with a "U" (not detected) during validation due to field blank contamination.

A limited sampling program was initiated within the rail yard area. Six locations were selected for which turbidity, total suspended solids, and uranium (dissolved and total) samples are being collected to ascertain if an identifiable source of both uranium and turbidity can be located; and if possible, the degree to which turbidity and uranium are related. The investigation of uranium is in response to the Ohio Environmental Protection Agency's (OEPA's) sampling program downstream of the railroad bridge in Paddys Run indicating an upward trend in uranium concentrations. While OEPA's data indicate an upward trend, their data do not indicate that an exceedance of a surface water total uranium FRL is occurring. The preliminary results from the six locations in the rail yard area were presented to OEPA during the conference call on October 31, 2000. Additional sampling of the drainage from the solid waste landfill was also identified during this conference call. This sampling program was not completed as of September 30, 2000; however, results from this investigation will be summarized in a future IEMP report.

Routine turbidity monitoring in Paddys Run in the vicinity of the northern drainage ditch as related to the state threatened Sloan's crayfish continued in the third quarter of 2000. Observations were made following each significant rainfall event (total of four), and no unexpected conditions were observed.

TABLE 3-1

2000 STORM WATER RETENTION BASIN OVERFLOWS AND TREATMENT BYPASS EVENTS

Event	Duration (hours)	Number of Bypass Days[a]	Cumulative Number of Bypass Days	Total Uranium Discharged (pounds)	Total Water Discharged (millions of gallons)
Overflows				(to Paddys Run)	(to Paddys Run)
January 4	16.16	1	1	8.53	4.041
Significant Precipitation Bypasses				(to Great Miami River)	(to Great Miami River)
January 3 through January 5	39.67	1	1	4.19	2.455
February 18 through February 19	30.50	1	2	5.87	2.064

[a]Days are counted according to the definition provided in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project (DOE 1999b).

TABLE 3-2

SURFACE WATER LOCATIONS WITH RESULTS ABOVE THE FRL AND BTV, INCLUDING SUMMARY STATISTICS

Sample Location	Constituent	Total Number of Samples Since January 1, 1997[a,b,c]	Number of Samples with FRL and BTV Exceedances Since January 1, 1997[a,b,c]	Number of Samples with FRL and BTV Exceedances for Second Quarter 2000[a,b,c]	FRL/BTV (mg/L)	Summary Statistics[b,d,e] Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	Results with FRL Exceedances for Second Quarter 2000 Sample Result (mg/L)	Validation Qualifier[f]	Sample Date
SWD-03 (Waste Storage Area)	Silver	10	1	1	0.005/0.0013	0.000046	0.0106	0.0013	0.0106	J	4/4/00

[a]Total number of samples is from all programs including NPDES, NPDES Permit renewal, FFCA, and IEMP Characterization Program.
[b]If more than one sample is collected per surface water location per day (e.g., duplicate, grab, composite), then only one sample is counted for the total number of samples and the sample with the maximum concentration is used for the summary statistics and in determining FRL exceedances.
[c]Rejected data qualified with either a R or Z were not used for this table.
[d]If the total number of samples is greater than or equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then none of the summary statistics are reported.
[e]For results where the concentrations are below the detection limit, the results used in the summary statistics are each set at half the detection limit.
[f]Validation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998).

FIGURE 3-1

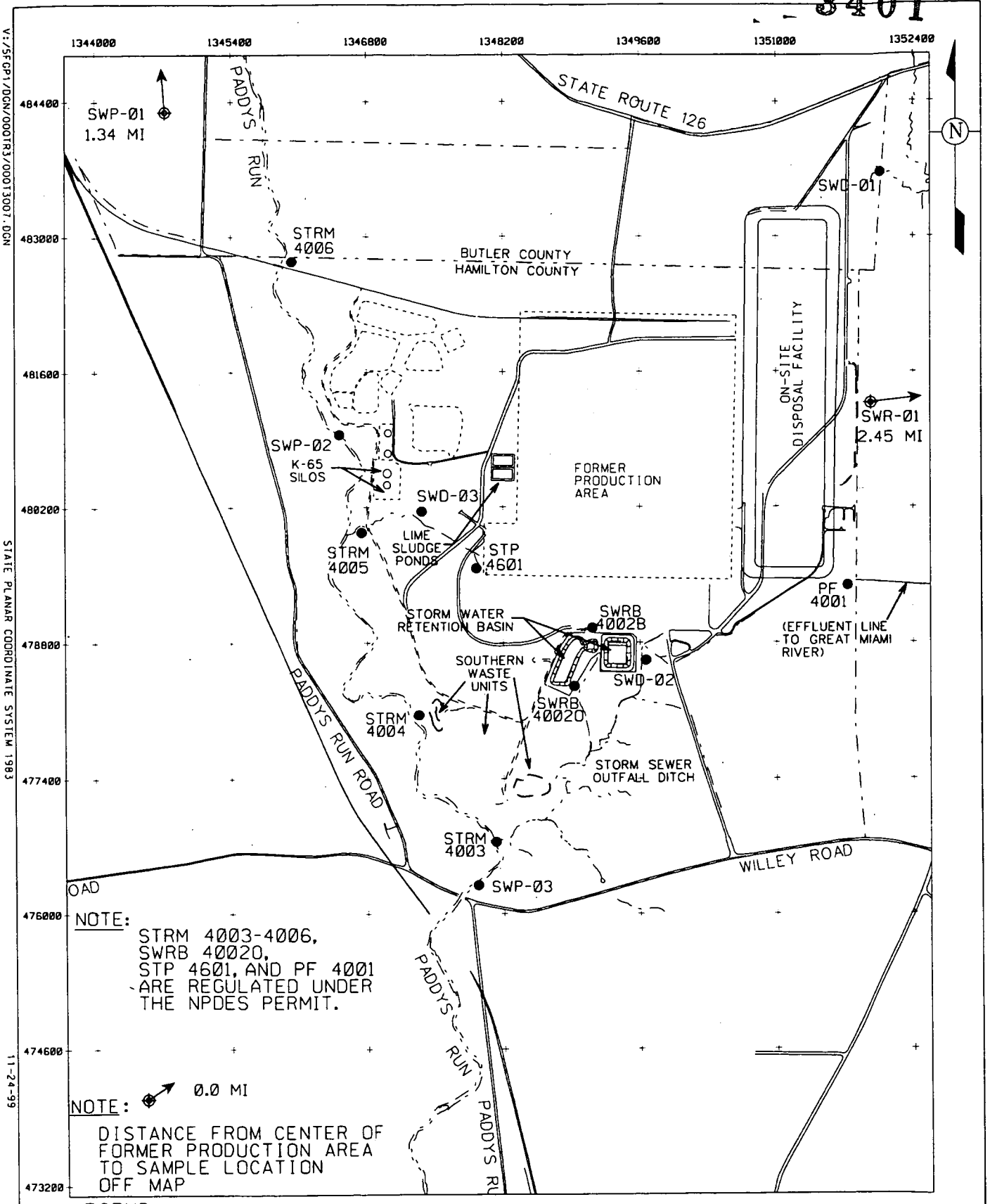
SURFACE WATER AND TREATED EFFLUENT SAMPLING ACTIVITIES[a]

SAMPLING ACTIVITIES[b]	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NPDES							◆	◆	◆			
FFCA							◆	◆	◆			
IEMP Characterization				◆	◆	◆						

◆ Data summarized/evaluated in this report

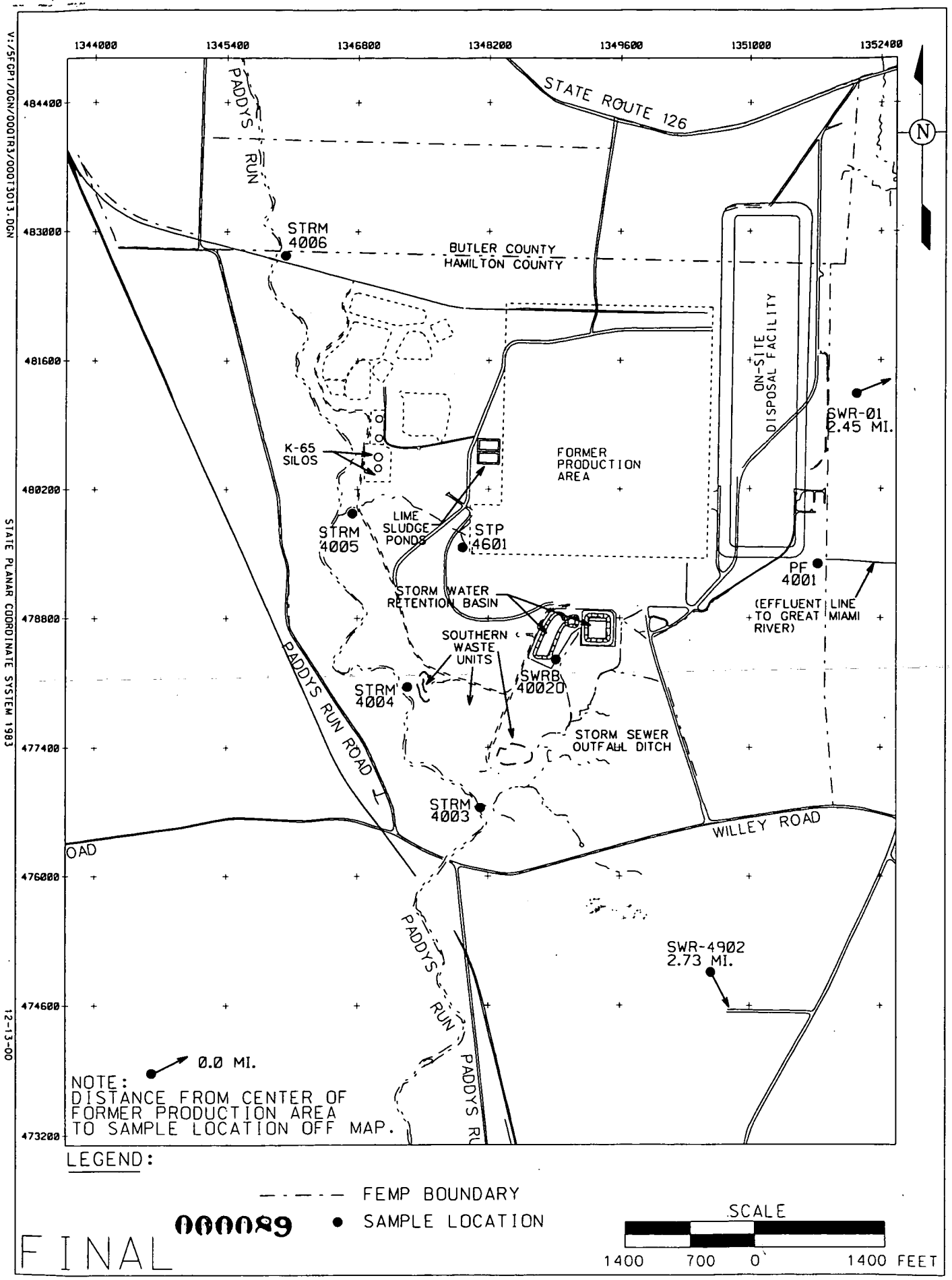
FINAL

[a]Future data will be reported through the IEMP Extranet Site and quarterly summaries.
[b]Some samples are collected to support more than one surface water sampling activity.



FINAL

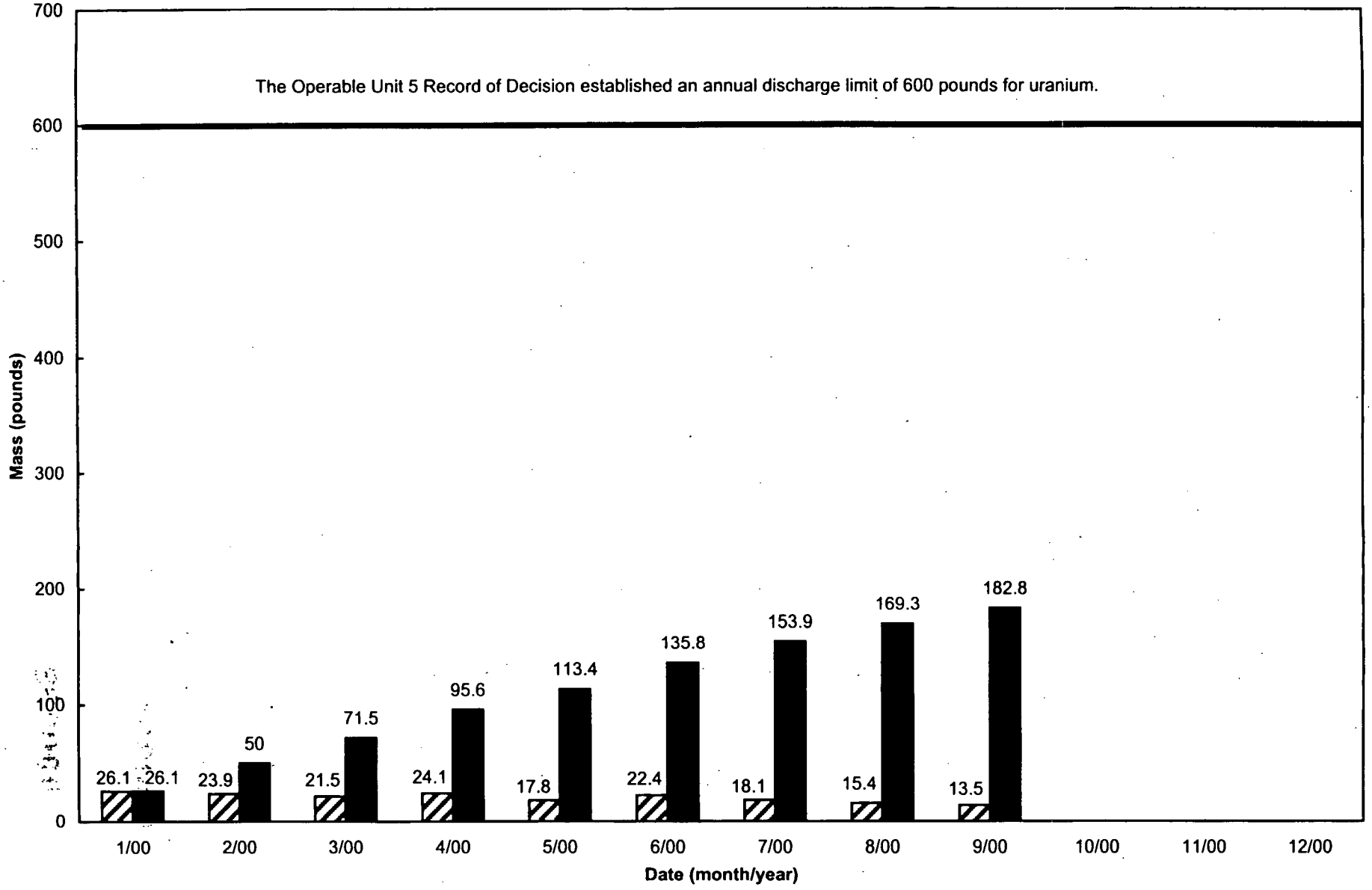
FIGURE 3-2. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS



000089

FINAL

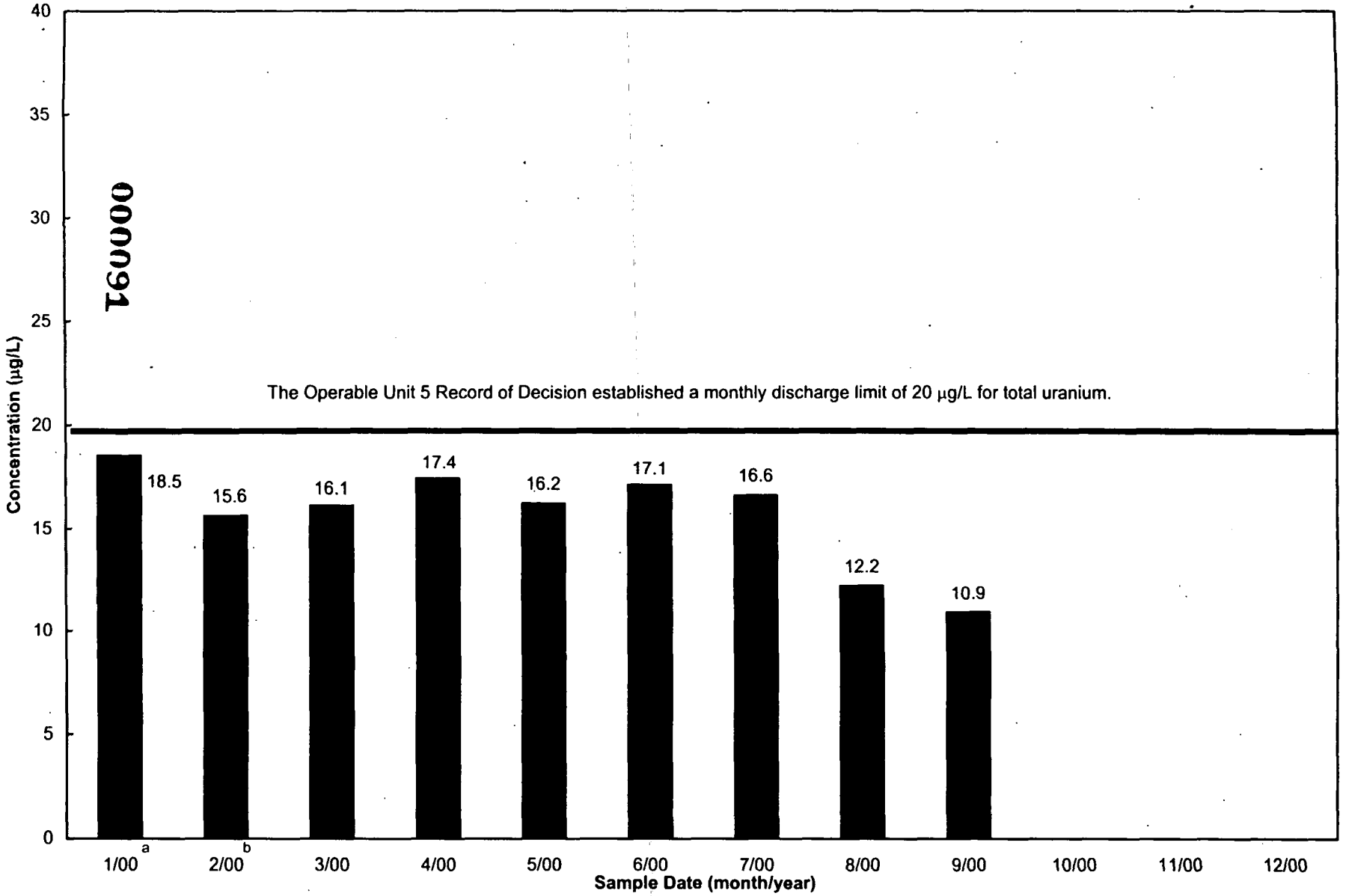
FIGURE 3-3. NPDES PERMIT SAMPLE LOCATIONS



Note: Sum of monthly discharges may not always agree with cumulative total due to rounding differences.

FINAL

FIGURE 3-4. POUNDS OF URANIUM DISCHARGED TO THE GREAT MIAMI RIVER FROM THE PARSHALL FLUME (PF 4001) IN 2000

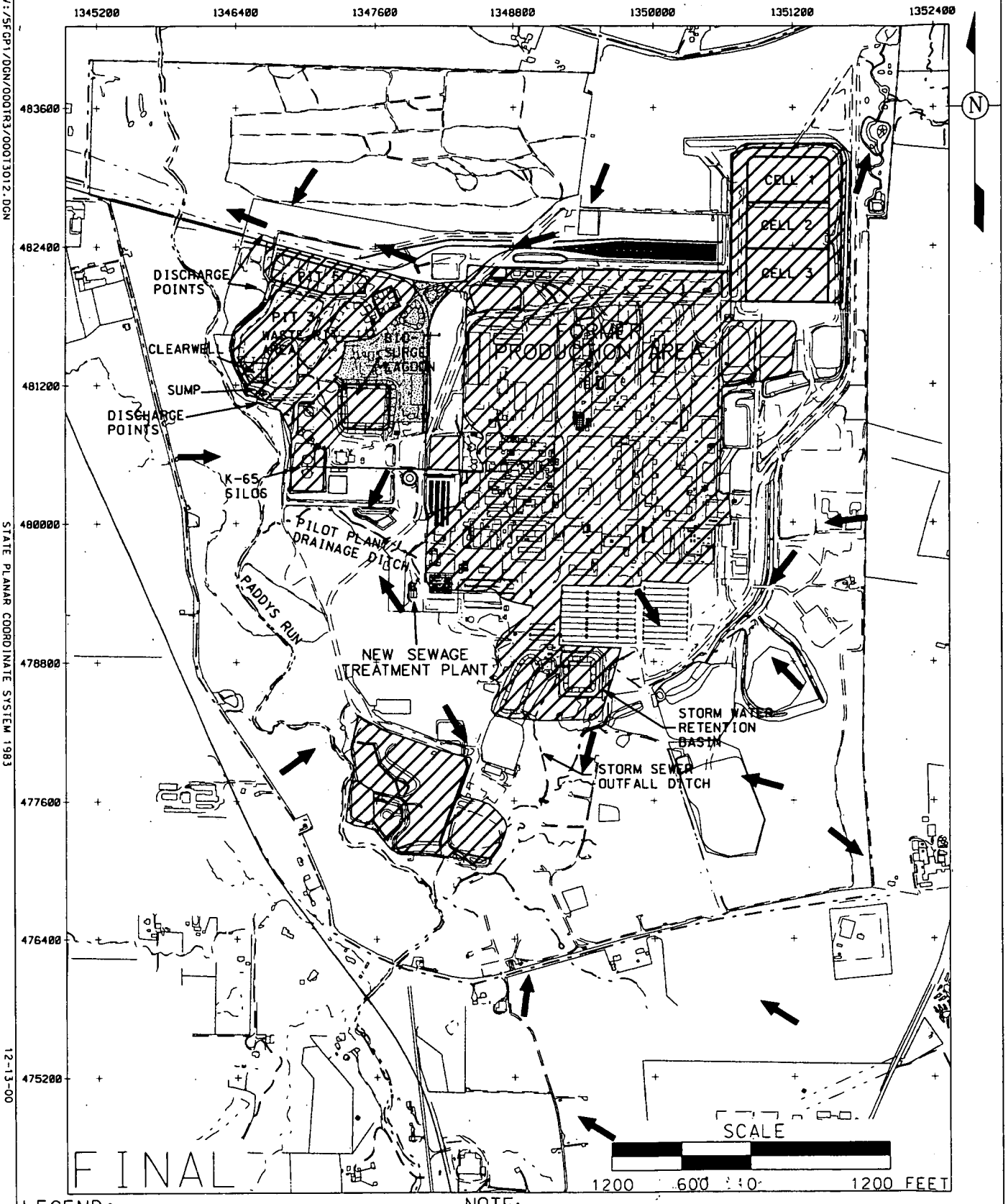


[a] Actual concentration was 20.9 µg/L. Eliminating one "significant precipitation" bypass day reduces average to 18.5 µg/L.

[b] Actual concentration was 18.7 µg/L. Eliminating one "significant precipitation" bypass day reduces average to 15.6 µg/L.

FIGURE 3-5. 2000 MONTHLY AVERAGE TOTAL URANIUM CONCENTRATION IN WATER DISCHARGED FROM THE PARSHALL FLUME (PF 4001) TO THE GREAT MIAMI RIVER

FINAL



000092

FIGURE 3-6. CONTROLLED SURFACE WATER AREAS AND UNCONTROLLED FLOW DIRECTIONS FOR THIRD QUARTER 2000

Air Monitoring

4.0 AIR MONITORING

This section provides a summary of the third quarter 2000 monitoring activities and analytical results for the Integrated Environmental Monitoring Plan (IEMP) air monitoring program. Figure 4-1 shows the data included in this section. Analytical results from the following routine air monitoring program elements and project-specific air monitoring activities covered in this section include:

- Radiological Air Particulate Monitoring:
  - National Emissions Standards for Hazardous Air Pollutants (NESHAP) Compliance
  - Monitoring Thorium Emissions from the Waste Pits Remedial Action Project (WPRAP)
- NESHAP Stack Emissions Monitoring
- Radon Monitoring:
  - Continuous Alpha Scintillation Monitoring - Silo Head Space and Environmental Data
- Direct Radiation Monitoring (via thermoluminescent dosimeters [TLDs]).

Monitoring activities defined under the IEMP for radiological particulate, stack, radon, and direct radiation monitoring will continue as planned during the fourth quarter of 2000.

4.1 RADIOLOGICAL AIR PARTICULATE MONITORING

4.1.1 TOTAL URANIUM, TOTAL PARTICULATE AND THORIUM

The average third quarter 2000 airborne uranium particulate concentrations indicated a slight reduction over the second quarter 2000 concentrations at 10 of the 16 fenceline air particulate monitoring locations. Total uranium particulate samples are analyzed biweekly in order to track changes in fenceline uranium concentrations due to emissions from remediation projects. The general decrease in third quarter averages is attributed to the gradual decrease of earthmoving remediation projects during the third quarter.

Figure 4-2 identifies the location of the air monitoring stations. Table 4-1 provides a summary of third quarter 2000, year-to-date, and historical total uranium concentrations. Third quarter and historical total uranium concentration graphs for each location can be viewed by going to Table 4-1 and selecting the appropriate location. Table 4-2 provides a summary of third quarter, year-to-date, and historical total particulate concentrations. Third quarter and historical total particulate concentration graphs for each location can be viewed by going to Table 4-2 and selecting the appropriate location. As indicated by the graphs, total particulate concentrations at the fenceline locations during the third quarter of 2000 are also lower than second quarter 2000 total particulate concentrations at 15 of the 16 fenceline monitoring locations.

The waste pit monitors (refer to Figure 4-2 for WPTH-1 and WPTH-2 locations) were installed to address potential increases in airborne thorium concentrations, specifically thorium-230, that may result from fugitive emissions from the excavation of the waste pits. Third quarter thorium-230 concentrations measured at WPTH-1 and WPTH-2 (refer to Figure 4-21 and Figure 4-22, respectively) reflect the continuing excavation of Waste Pits 1 and 3 and the associated material handling operations within WPRAP. These temporary increases were attributed to fugitive emissions from handling the waste material, while the decreases were most likely due to the implementation of additional dust control measures and suspension of operations during stand-down periods. Thorium concentrations at WPTH-1 and WPTH-2 will continue to be monitored biweekly in order to assess the impact of emissions resulting from excavation of the waste pits and material handling associated with WPRAP dryer operations. As a result of intermittent elevated thorium-230 concentrations, thorium monitoring at all of the fenceline monitoring stations will commence in the fourth quarter of 2000 on a biweekly basis. This monitoring will provide a more comprehensive data set in order to provide timely feedback to WPRAP concerning the effectiveness of thorium-emission mitigation efforts.

Figure 4-23 and Figure 4-24 show historical concentration versus time plots of thorium-228 and thorium-232 at WPTH-1 and WPTH-2, respectively. As indicated by the plots, the airborne concentrations of thorium-228 and thorium-232 at the monitors are comparable to background and have generally remained consistent throughout the third quarter. These fenceline data reflect the fact that the concentrations of thorium-228 and thorium-232 in the waste pit material are relatively low in comparison to concentrations of thorium-230, which is in the uranium-238 decay chain. WPRAP operations are not expected to significantly impact the fenceline concentrations of thorium-228 and thorium-232.

4.1.2 NESHAP COMPLIANCE

The maximum third quarter 2000 dose equivalent, calculated from third quarter air composite data, was 0.13 millirem (mrem) and occurred at AMS-9C. This third quarter dose is a reduction from the maximum second quarter 2000 dose of 0.38 mrem, likely due to the suspension of normal WPRAP operations in late August 2000. For seasonal comparison purposes, the maximum third quarter 2000 dose of 0.13 mrem represents a slight increase over the third quarter 1999 dose of 0.10 mrem; however, WPRAP excavation activities did not begin until the fourth quarter of 1999. On-site disposal facility operations were active during both third quarter periods in 1999 and 2000. Table 4-3 contains the third quarter doses for each air monitoring station and the fractional contribution of each radionuclide to the total dose. The doses at the WPTH-1 and WPTH-2 monitors, which were installed to address potential increases in airborne thorium concentrations that may result from WPRAP fugitive emissions, are not reported in Table 4-3. However, it should be noted that the thorium concentrations and dose at the WPTH-1 monitor are comparable to the thorium dose measured at AMS-28 and the thorium concentrations and dose at the WPTH-2 monitors are comparable to the thorium dose measured at AMS-27.

The maximum year-to-date dose equivalent, calculated from the sum of three quarterly air composites, was 0.85 mrem which occurred at AMS-3. This maximum year-to-date fenceline dose represents 8.5 percent of the 10 mrem NESHAP Subpart H standard. Table 4-4 contains the year-to-date doses for each air monitoring station and the fractional contribution of each radionuclide to the total dose. On average, isotopes of thorium contributed approximately 58 percent of the year-to-date dose at the fenceline air monitoring stations. In particular, thorium-230 contributed 50 percent of the dose at the fenceline air monitoring stations. On average, uranium and radium-226 contributed approximately 22 percent and 19 percent, respectively, of the doses at the fenceline air monitoring stations. These relative contributions to the fenceline dose equivalent are notably different than historical dose contribution data, which indicate uranium typically contributes greater than 62 percent of the dose based on an evaluation of fenceline monitoring results from 1990 to 1998. The increase in the percentage of dose from thorium, specifically thorium-230, is attributed to emissions from the excavations and subsequent material handling associated with WPRAP.

As a result of continued elevated thorium-230 concentrations during the third quarter, WPRAP has modified its operations and facilities in an effort to reduce the fugitive emissions from the excavation, transport, and handling of the waste pit materials. Additionally, as a result of the increase in percentage of dose from thorium and in accordance with the data evaluation process described in the IEMP, isotopic thorium analysis began in October 2000 on each biweekly IEMP air particulate sample from all 16 stations around the site perimeter. Biweekly total uranium analysis will continue at all 16 fenceline stations and the quarterly composite analysis schedule will remain the same. The addition of biweekly isotopic thorium analyses will provide more timely data for monitoring fenceline thorium levels and trending dose from airborne emissions.

NESHAP STACK EMISSIONS MONITORING

Table 4-5 includes the NESHAP stack emissions monitoring results and Figure 4-25 shows the NESHAP stack emissions monitoring locations. Third quarter 2000 results for Building 71 are within expected ranges. Typically, post production (1991 to present) stack monitoring results are near or below the minimum detectable concentration (MDC) levels for all isotopes monitored. The laundry stack monitoring was discontinued on February 2, 2000, due to suspension of laundry operations.

The WPRAP dryer stack began operations late in the fourth quarter of 1999. Third quarter 2000 results also indicate levels near or below MDC levels for all isotopes, excluding radon. The WPRAP dryer stack contains a continuous radon (i.e., radon-220 and radon-222) monitor. During dryer operations, the maximum daily release of radon (radon-220 and radon-222) from the dryer stack was 1,471 μCi, which is below the estimated maximum hourly release rate of 13,000 μCi/hr for radon-222. Although radon stack monitoring is not required per the NESHAP Subpart H regulations, Table 4-5 includes a summary of the results from the stack radon monitor.

4.2 RADON MONITORING

4.2.1 ENVIRONMENTAL RADON

Table 4-6 summarizes third quarter 2000 and historical environmental radon data from continuous monitors. Third quarter 2000 average radon concentrations at all boundary locations (refer to Figure 4-26) were below the 3 picoCuries per liter (pCi/L) above background annual average radon concentration limit.

As expected, the highest continuous environmental radon monitoring results were recorded at the K-65 exclusion fence. In general, third quarter 2000 radon levels at the four K-65 exclusion fence monitors were lower than during the same quarterly period in 1999. The third quarter 2000 combined average radon concentration for the four K-65 exclusion fence monitors was approximately 54 percent lower than the third quarter 1999 average, suggesting the 1999 silo re-sealing effort still remains effective.

During the third quarter of 2000, there were no exceedances of the U.S. Department of Energy Order 5400.5 100 pCi/L radon limit. For comparison, there were also no exceedances of the 100 pCi/L radon limit during the third quarter of 1999.

4.2.2 SILO HEADSPACE

K-65 Silo headspace radon concentrations fluctuate seasonally due to changes in meteorological parameters (e.g., temperature, barometric pressure, humidity, etc.). To account for the seasonal variations, concentrations are summarized quarterly (from the daily average concentrations) in order to compare data collected under similar meteorological conditions. Table 4-7 presents average headspace radon concentrations by month, utilizing data from the continuous monitoring system. Monthly average radon concentrations for K-65 Silo 1 during the third quarter of 2000 ranged between 19.2 and 19.3 million pCi/L. The quarterly average concentration increased approximately 40 percent over the quarterly average concentration during the same period in 1999. The average concentration for Silo 1 is approximately 74 percent of the pre-bentonite concentration level (~26 million pCi/L). Third quarter 2000 monthly average continuous monitoring results for K-65 Silo 2 ranged between 15.6 and 16.8 million pCi/L. The quarterly average concentration increased approximately 86 percent from the average concentration during the same period in 1999. The average concentration for Silo 2 is approximately 53 percent of the pre-bentonite concentration level (~30 million pCi/L).

The increases in the reported silos headspace radon concentrations are due in part to the application of correction factors which are used to account for the non-equilibrium conditions encountered when calculating and reporting headspace radon concentrations using the continuous monitoring system. The development and application of these correction factors was presented in previous quarterly status reports. The increases are also the result of the gradual deterioration in the effectiveness of the bentonite seal layer with the silos which has also been previously reported and discussed.

On September 20, 2000, the cables that transmit headspace concentration data in a real-time mode to the Communications Center were severed during project construction activities. After the cables were severed, the headspace monitors continued to operate and the headspace concentrations were routinely checked to ensure the monitors were operating properly and the headspace concentrations were within the expected range of values. However, the severed cables did hamper the ability to efficiently trend and average headspace concentrations. The cables were repaired on October 13, 2000, and real-time data transmission and trending capabilities were restored. As indicated in Table 4-7, the September average headspace concentration data are from the period when the headspace data were being electronically recorded and averaged. The loss of the electronically recorded data during the last 10 days of September would not be expected to have a significant effect on the September monthly average radon concentrations because headspace values are relatively constant over such a short time period.

4.3 DIRECT RADIATION (TLD) MONITORING

All monitoring results from direct radiation measurements for the third quarter of 2000 were within historical ranges. Figure 4-28 depicts the monitoring locations and direct radiation measurements are shown in Table 4-8. As noted in previous IEMP quarterly status reports, a positive trend in the immediate area of the K-65 Silos (locations 22 through 26) has been identified and will continue to be monitored (refer to Figure 4-29). This trend is attributed to a corresponding increase in radon and radon-progeny concentrations observed in the K-65 Silo headspace. The increase in direct radiation measurements adjacent to the silos is still well below the levels observed prior to the addition of bentonite to the silos in 1991.

As discussed in previous reports, a slight positive trend in direct radiation measurements at the site fenceline nearest the K-65 Silos (location 6) has been identified. The trend is associated with the increasing direct radiation levels at the K-65 Silos, as discussed above. The upward trend at the site fenceline nearest the K-65 Silos is difficult to measure consistently due to small variations in the sensitivity and accuracy of the environmental TLDs. Figure 4-30 shows the slight positive trend at location 6.

During the third quarter of 2000, one of the background direct radiation measurement devices was lost. This TLD was lost during the transition from the previous homeowner to the current homeowner, due to the sale of the property. Therefore, TLD location 18 reflects an extrapolated year-to-date result and will be replaced by TLD location 42 in the fourth quarter of 2000 (refer to Figure 4-28).

TABLE 4-1

TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR

	Third Quarter 2000 Results[a] (pCi/m³ x 1E-6)				2000 Summary Results[a] (pCi/m³ x 1E-6)				1990 through 1999 Summary Results[a] (pCi/m³ x 1E-6)	
Location	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	7	27	264	90	20	22	264	95	0	3500
AMS-3	7	54	257	118	20	34	424	149	0	17000
AMS-4	7	10	78	42	20	10	127	43	0	2300
AMS-5	7	13	81	46	20	0.0	81	38	0	4400
AMS-6	7	0.0	213	115	20	0.0	213	79	0	3200
AMS-7	7	2.7	36	24	20	2.7	101	31	0	7800
AMS-8A	7	51	285	189	20	25	841	179	0	1135
AMS-9C[b]	7	41	273	164	20	26	303	151	0	562
AMS-22	7	28	113	75	20	0.52	238	76	0	101
AMS-23	7	23	76	55	20	15	191	71	0	202
AMS-24	7	16	83	33	20	12	133	39	0	112
AMS-25	7	0.0	65	26	20	0.0	125	29	0	402
AMS-26	7	20	112	52	20	9.4	114	40	0	171
AMS-27	7	13	104	57	20	12	124	47	0	101
AMS-28	7	20	69	40	20	2.2	153	66	0	445
AMS-29	7	10	184	68	20	10	184	58	0	199
Background										
AMS-12	7	0.0	13	6.1	20	0.0	30	11	0	480
AMS-16	7	2.6	19	12	20	2.6	143	21	0	350

[a]For blank corrected concentrations less than or equal to 0.0 pCi/m³, the concentration is set as 0.0 pCi/m³.
[b]Summary results for 1990 through 1999 include AMS-9B/C data.

TABLE 4-2

TOTAL PARTICULATE CONCENTRATIONS IN AIR

	Third Quarter 2000 Results ($\mu g/m^3$)				2000 Summary Results ($\mu g/m^3$)				1990 through 1999 Summary Results ($\mu g/m^3$)	
Location	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	7	28	38	33	20	17	39	29	7.0	77
AMS-3	7	28	39	33	20	17	44	31	8.0	159
AMS-4	7	27	35	31	20	19	45	30	13	79
AMS-5	7	24	33	28	20	20	44	29	9.6	62
AMS-6	7	26	36	31	20	20	45	30	8.0	69
AMS-7	7	27	37	31	20	20	52	33	6.8	84
AMS-8A	7	30	35	33	20	20	67	34	13	89
AMS-9C[a]	7	30	36	33	20	19	46	31	7.1	136
AMS-22	7	25	35	31	20	21	45	32	13	57
AMS-23	7	22	33	28	20	17	45	28	15	57
AMS-24	7	33	54	40	20	5.4	54	33	13	79
AMS-25	7	29	40	33	20	23	47	33	17	69
AMS-26	7	23	33	29	20	20	40	28	15	52
AMS-27	7	38	55	46	20	30	72	47	16	92
AMS-28	7	21	34	27	20	16	68	28	12	51
AMS-29	7	26	38	32	20	18	45	30	11	62
Background										
AMS-12[b]	7	21	30	26	20	17	39	26	6.0	416
AMS-16[b]	7	35	45	41	20	27	52	40	18	84

[a]Summary results for 1990 through 1999 include AMS-9B/C data.
[b]Total particulate analysis was discontinued during 1994 and was reinstated for AMS-12 and AMS-16 in 1997.

TABLE 4-3

THIRD QUARTER NESHAP COMPLIANCE TRACKING

	40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios[a]													
Location	Ac-228[b]	Ra-224[b]	Ra-226	Ra-228[b]	Th-228	Th-230	Th-231[b]	Th-232	Th-234[b]	U-234	U-235/ U-236	U-238	Ratio Totals	Dose[c] (mrem)
Fenceline														
AMS-2	2.9E-08	7.0E-07	--	1.8E-05	--	2.1E-03	1.9E-09	1.7E-04	4.9E-06	9.7E-04	7.3E-05	1.3E-03	0.005	0.05
AMS-3	1.0E-07	2.5E-06	--	6.3E-05	1.0E-04	5.5E-03	3.1E-09	6.0E-04	7.0E-06	1.3E-03	1.2E-04	1.8E-03	0.010	0.01
AMS-4	1.1E-07	2.6E-06	--	6.7E-05	--	2.0E-03	1.5E-09	6.4E-04	1.7E-06	4.0E-04	6.0E-05	4.6E-04	0.004	0.04
AMS-5	1.6E-08	3.8E-07	--	9.7E-06	--	2.1E-03	--	9.3E-05	2.2E-06	4.2E-04	--	5.8E-04	0.003	0.03
AMS-6	2.8E-08	7.0E-07	4.4E-04	1.8E-05	--	5.9E-03	--	1.7E-04	6.4E-06	6.5E-04	--	1.7E-03	0.009	0.09
AMS-7	--	--	--	--	--	9.9E-04	--	--	9.9E-07	2.4E-04	--	2.6E-04	0.001	0.01
AMS-8A	3.1E-08	7.6E-07	--	1.9E-05	1.8E-06	4.3E-03	3.7E-09	1.8E-04	9.6E-06	1.9E-03	1.5E-04	2.5E-03	0.009	0.09
AMS-9C	2.3E-07	5.8E-06	6.8E-04	1.5E-04	8.6E-05	6.2E-03	2.6E-09	1.4E-03	8.6E-06	1.7E-03	1.0E-04	2.3E-03	0.013	0.13
AMS-22	5.8E-08	1.4E-06	6.0E-04	3.6E-05	--	3.9E-03	1.1E-09	3.5E-04	4.1E-06	6.3E-04	4.5E-05	1.1E-03	0.007	0.07
AMS-23	7.9E-09	1.9E-07	--	4.9E-06	--	2.2E-03	--	4.7E-05	3.4E-06	4.4E-04	--	9.1E-04	0.004	0.04
AMS-24	2.2E-07	5.4E-06	3.5E-04	1.4E-04	2.3E-04	2.1E-03	1.9E-09	1.3E-03	1.7E-06	1.1E-03	7.4E-05	4.6E-04	0.006	0.06
AMS-25	2.7E-08	6.6E-07	--	1.7E-05	--	1.5E-03	1.2E-09	1.6E-04	1.3E-06	2.5E-04	4.7E-05	3.5E-04	0.002	0.02
AMS-26	--	--	--	--	4.1E-05	2.8E-03	--	--	3.1E-06	5.4E-04	--	8.1E-04	0.004	0.04
AMS-27	6.9E-09	1.7E-07	4.6E-04	4.3E-06	1.6E-04	3.0E-03	1.3E-09	4.1E-05	3.2E-06	4.4E-04	4.9E-05	8.5E-04	0.005	0.05
AMS-28	--	--	--	--	2.2E-04	2.1E-03	1.7E-09	--	1.9E-06	3.6E-04	6.5E-05	5.1E-04	0.003	0.03
AMS-29	9.8E-09	2.4E-07	1.2E-03	6.2E-06	8.4E-05	2.8E-03	2.2E-09	5.9E-05	4.1E-06	8.3E-04	8.5E-05	1.1E-03	0.006	0.06
Background														
AMS-12	2.2E-07	5.4E-06	5.0E-03	1.4E-04	3.8E-04	3.7E-04	--	1.3E-03	4.7E-07	9.2E-05	--	1.3E-04	NA[d]	
AMS-16	5.0E-07	1.2E-05	5.7E-03	3.1E-04	7.9E-04	7.7E-04	--	3.0E-03	9.9E-07	2.7E-04	--	2.6E-04	NA[d]	
QA/QC														
Column Check[e]	0.000	0.000	0.038	0.005	0.009	0.494	0.000	0.052	0.001	0.122	0.009	0.170	NA[d]	0.90

Maximum Quarterly Ratio: 0.013
Maximum Quarterly Dose (mrem): 0.13

[a]A "--" indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.
[b]Isotopes assumed to be in equilibrium with their parents.
[c]Dose conversions are based on the NESHAP standard of 10 mrem per year.
[d]NA = not applicable
[e]Column check is the sum of doses from each radionuclide, followed by the sum of doses (0.90) at all fenceline monitors.

TABLE 4-4

YEAR-TO-DATE NESHAP COMPLIANCE TRACKING

	40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios[a]													
Location	Ac-228[b]	Ra-224[b]	Ra-226	Ra-228[b]	Th-228	Th-230	Th-231[b]	Th-232	Th-234[b]	U-234	U-235/ U-236	U-238	Ratio Totals	Dose[c] (mrem)
Fenceline														
AMS-2	2.0E-07	4.9E-06	1.7E-03	1.2E-04	1.5E-04	9.2E-03	5.8E-09	1.2E-03	1.5E-05	2.9E-03	2.3E-04	3.9E-03	0.019	0.19
AMS-3	9.3E-07	2.3E-05	1.2E-02	5.8E-04	7.3E-04	5.3E-02	1.4E-08	5.6E-03	2.8E-05	5.6E-03	5.3E-04	7.5E-03	0.085	0.85
AMS-4	3.6E-07	8.8E-06	2.8E-03	2.2E-04	7.3E-05	7.3E-03	4.1E-09	2.1E-03	5.4E-06	1.1E-03	1.6E-04	1.4E-03	0.015	0.15
AMS-5	1.5E-07	3.6E-06	2.7E-03	9.1E-05	2.0E-04	8.1E-03	1.8E-09	8.7E-04	6.2E-06	9.5E-04	7.0E-05	1.7E-03	0.015	0.15
AMS-6	2.5E-07	6.1E-06	1.8E-03	1.5E-04	1.0E-04	1.4E-02	2.5E-09	1.5E-03	1.2E-05	1.6E-03	9.6E-05	3.2E-03	0.023	0.23
AMS-7	2.2E-07	5.5E-06	3.8E-03	1.4E-04	2.1E-04	4.2E-03	2.5E-09	1.3E-03	5.4E-06	9.8E-04	9.7E-05	1.4E-03	0.012	0.12
AMS-8A	4.8E-07	1.2E-05	2.2E-03	3.0E-04	3.1E-04	2.1E-02	1.2E-08	2.9E-03	3.2E-05	6.8E-03	4.5E-04	8.5E-03	0.043	0.43
AMS-9C	1.0E-06	2.6E-05	7.1E-03	6.5E-04	1.8E-04	2.7E-02	8.4E-09	6.2E-03	2.4E-05	4.8E-03	3.3E-04	6.4E-03	0.053	0.53
AMS-22	1.9E-07	4.6E-06	3.1E-03	1.2E-04	5.2E-06	9.8E-03	2.5E-09	1.1E-03	9.9E-06	1.5E-03	9.8E-05	2.6E-03	0.018	0.18
AMS-23	4.5E-07	1.1E-05	6.0E-03	2.8E-04	3.7E-04	9.6E-03	2.5E-09	2.7E-03	9.6E-06	1.6E-03	9.9E-05	2.6E-03	0.023	0.23
AMS-24	4.5E-07	1.1E-05	3.2E-03	2.8E-04	2.7E-04	1.6E-02	4.9E-09	2.7E-03	1.2E-05	2.6E-03	1.9E-04	3.3E-03	0.028	0.28
AMS-25	2.8E-07	7.0E-06	8.3E-03	1.8E-04	2.7E-04	8.6E-03	2.6E-09	1.7E-03	5.5E-06	9.3E-04	1.0E-04	1.4E-03	0.021	0.21
AMS-26	4.8E-08	1.2E-06	3.5E-03	3.0E-05	1.5E-04	7.4E-03	2.4E-09	2.8E-04	6.7E-06	1.1E-03	9.3E-05	1.8E-03	0.014	0.14
AMS-27	3.0E-07	7.5E-06	8.9E-03	1.9E-04	5.2E-04	8.4E-03	1.3E-09	1.8E-03	8.0E-06	1.2E-03	4.9E-05	2.1E-03	0.023	0.23
AMS-28	--	--	1.2E-03	--	2.2E-04	1.4E-02	5.5E-09	--	1.5E-05	1.6E-03	2.2E-04	3.9E-03	0.021	0.21
AMS-29	3.2E-07	7.9E-06	7.5E-03	2.0E-04	2.1E-04	1.2E-02	5.9E-09	1.9E-03	1.1E-05	2.1E-03	2.3E-04	2.8E-03	0.026	0.26
Background														
AMS-12	7.5E-07	1.8E-05	1.5E-02	4.7E-04	1.5E-03	1.5E-03	6.2E-10	4.5E-03	2.2E-06	5.7E-04	2.4E-05	5.9E-04	NA[d]	
AMS-16	9.9E-07	2.4E-05	1.4E-02	6.2E-04	1.8E-03	1.6E-03	--	5.9E-03	2.0E-06	5.5E-04	--	5.3E-04	NA[d]	
QA/QC														
Column Check[e]	0.000	0.001	0.752	0.035	0.040	2.292	0.000	0.337	0.002	0.373	0.030	0.544	NA[d]	4.41

Maximum Year-To-Date Ratio: 0.085
Maximum Year-To-Date Dose (mrem): 0.85

[a]A "--" indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.
[b]Isotopes assumed to be in equilibrium with their parents.
[c]Dose conversions are based on the NESHAP standard of 10 mrem per year.
[d]NA = not applicable
[e]Column check is the sum of doses from each radionuclide, followed by the sum of doses (4.41) at all fenceline monitors.

TABLE 4-5

NESHAP STACK EMISSION MONITORING RESULTS

Analysis Performed	Third Quarter 2000 Results		2000 Summary Results		1999 Summary Results	
	No. of Samples[a,b]	Total Pounds[a,c]	No. of Samples[a]	Total Pounds[a,c]	No. of Samples[a]	Total Pounds[a,c]
Building 71 Stack						
Uranium, Total	1	4.6E-06	3	3.1E-06	5	2.6E-05
Thorium-232	1	1.1E-05	3	1.5E-05	5	5.2E-05
Thorium-230	1	1.2E-10	3	2.7E-10	5	1.0E-09
Total Particulate	1	0.0E+00	2	0.0E+00	3[d]	5.8E-01
Laundry Stack[e]						
Uranium, Total	NS	NA	2	1.4E-05	9	2.6E-05
Thorium-232	NS	NA	2	7.5E-05	9	5.8E-04
Thorium-230	NS	NA	2	9.0E-10	9	6.9E-09
Total Particulate	NS	NA	2	7.0E-02	7[d]	6.0E-01
WPRAP Dryer Stack						
Uranium-238	1	ND	7	2.8E-05[f]	1	ND
Uranium-235/236	1	ND	7	9.6E-08	1	ND
Uranium-234	1	ND	7	1.5E-09[f]	1	ND
Thorium-232	1	ND	7	3.5E-07	1	ND
Thorium-230	1	1.7E-11	7	4.3E-10[f]	1	ND
Thorium-228	1	ND	7	3.9E-16[f]	1	ND
Radium-226[g]	1	ND	7	3.2E-11[f]	1	ND
Total Particulate	NS	NS	NS	NS	NS	NS

Analysis Performed	Third Quarter 2000 Results		
	Average Daily Release Rate (μCi)[h]	Maximum Daily Release Rate (μCi)[h]	Estimated Maximum Hourly Release Rate for Radon-222 (μCi/hr)
WPRAP Dryer Stack			
Radon-220/222	145.3	1,471	13,000

[a]ND = non-detectable
NA = not applicable
NS = not sampled
[b]WPRAP dryer stack sample consisted of six composited filters over three sampling periods.
[c]Total pounds are only determined from detected results.
[d]Some particulate result(s) could not be determined due to a damaged filter(s).
[e]Laundry dryers were shut down in February 2000.
[f]2000 summary results for WPRAP dryer stack include revised first quarter results.
[g]Radium-226 is not required to be analyzed in WPRAP dryer stack samples, but is provided for informational purposes.
[h]Reflects daily release rate information during period of operation from July through September

TABLE 4-6

CONTINUOUS ENVIRONMENTAL RADON MONITORING
MONTHLY AVERAGE CONCENTRATIONS[a]

	Third Quarter 2000 Monthly Results[b] (Instrument Background Corrected) (pCi/L)			2000 Summary Results[b] (Instrument Background Corrected) (pCi/L)			1999 Summary Results[b] (Instrument Background Corrected) (pCi/L)		
Location	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
Fenceline									
AMS-02	0.4	0.6	0.5	0.2	0.6	0.3	0.2	1.0	0.5
AMS-03	0.7	0.9	0.8	0.3	0.9	0.6	0.1	1.0	0.5
AMS-04	0.4	0.7	0.6	0.2	0.7	0.3	0.1	0.8	0.4
AMS-05	0.6	0.7	0.6	0.2	0.7	0.4	0.2	1.4	0.7
AMS-06	0.4	0.6	0.5	0.2	0.6	0.3	0.2	0.8	0.5
AMS-07	0.7	0.8	0.7	0.3	0.8	0.5	0.3	1.5	0.8
AMS-08A[c]	0.4	0.6	0.5	0.3	0.6	0.4	0.1	0.8	0.4
AMS-09C	0.4	0.7	0.6	0.1	0.7	0.3	0.2	0.8	0.5
AMS-22	0.3	0.4	0.3	0.1	0.5	0.3	0.1	0.5	0.3
AMS-23	0.3	0.3	0.3	0.1	0.3	0.2	0.1	0.6	0.3
AMS-24[c]	0.6	0.6	0.6	0.2	0.6	0.4	0.2	1.1	0.6
AMS-25[c]	0.4	0.5	0.4	0.2	0.5	0.3	0.2	0.8	0.5
AMS-26	0.4	0.6	0.5	0.2	0.6	0.3	0.2	0.8	0.5
AMS-27	0.5	0.7	0.6	0.2	0.7	0.4	0.2	1.1	0.6
AMS-28[c]	0.4	0.5	0.4	0.2	0.5	0.3	0.1	0.8	0.4
AMS-29[c]	0.4	0.5	0.4	0.3	0.7	0.4	0.1	0.8	0.4
Background									
AMS-12	0.3	0.4	0.4	0.1	0.4	0.2	0.1	0.5	0.2
AMS-16	0.2	0.3	0.2	0.1	0.3	0.2	0.1	0.5	0.3
On Site									
KNE	1.8	2.3	2.1	1.8	2.5	2.1	1.7	18.3	9.6
KNW	1.0	1.4	1.3	1.0	4.2	2.1	2.1	8.2	3.8
KSE	2.5	3.5	3.0	1.3	4.6	2.8	1.2	9.9	4.9
KSW	1.3	1.9	1.7	1.2	2.4	1.7	1.7	4.8	3.1
KNO[d]	3.1	3.6	3.3	2.2	3.6	3.0	NA[e]	NA[e]	NA[e]
KSO[d]	0.4	0.5	0.4	0.3	0.5	0.4	NA[e]	NA[e]	NA[e]
KTOP	1.8	8.9	4.4	1.8	8.9	3.8	3.4	15.8	8.4
Pilot Plant Warehouse	0.5	0.6	0.5	0.1	0.6	0.3	0.3	0.8	0.4
PR-1[f]	0.7	0.8	0.7	0.3	0.8	0.5	NA[e]	NA[e]	NA[e]
Rally Point 4	0.4	0.5	0.5	0.3	0.5	0.4	0.5	1.3	0.8
Surge Lagoon	0.4	0.6	0.5	0.2	0.6	0.4	0.4	1.0	0.7
T28	0.7	1.2	1.0	0.7	1.2	1.0	1.1	3.8	2.2
TS4[g]	0.3	0.5	0.4	0.1	0.5	0.2	0.2	0.9	0.5
WP-17A	0.4	0.6	0.5	0.2	0.6	0.4	0.1	1.1	0.6

[a]Monthly average radon concentrations are calculated from daily average concentrations. Daily average concentrations are calculated by summing all hourly count data, treating the sum as a single daily measurement, and then converting the sum to a (daily average) concentration.
[b]Instrument background changes as monitors are replaced
[c]Unit was placed in service in December 1998.
[d]Unit was placed in service in April 2000.
[e]NA = not applicable
[f]Unit was placed in service in March 2000.
[g]Unit was placed in service in January 1999.

TABLE 4-7

RADON HEADSPACE CONCENTRATIONS

	Radon Headspace Concentrations[a,b,c] (pCi/L)											
	Silo 1 2000			Silo 1 1999			Silo 2 2000			Silo 2 1999		
Month	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
January	1.71E+07	2.09E+07	1.81E+07	1.24E+07	1.44E+07	1.34E+07	1.44E+07	1.98E+07	1.66E+07	8.78E+06	1.11E+07	9.95E+06
February	1.58E+07	1.76E+07	1.69E+07	1.27E+07	1.35E+07	1.32E+07	1.50E+07	1.96E+07	1.75E+07	8.70E+06	9.68E+06	9.20E+06
March	1.56E+07	1.73E+07	1.64E+07	1.25E+07	1.33E+07	1.29E+07	1.45E+07	1.66E+07	1.56E+07	8.66E+06	9.89E+06	9.30E+06
April	1.59E+07	1.69E+07	1.63E+07	1.22E+07	1.30E+07	1.25E+07	1.43E+07	1.60E+07	1.51E+07	7.74E+06	8.53E+06	8.10E+06
May	1.56E+07	1.99E+07	1.81E+07	1.21E+07	1.32E+07	1.26E+07	1.39E+07	1.57E+07	1.50E+07	7.77E+06	8.73E+06	8.21E+06
June	1.61E+07	2.04E+07	1.75E+07	1.25E+07	1.36E+07	1.30E+07	1.47E+07	1.61E+07	1.52E+07	8.04E+06	9.08E+06	8.50E+06
July	1.89E+07	2.01E+07	1.93E+07	1.26E+07	1.43E+07	1.36E+07	1.54E+07	1.68E+07	1.56E+07	8.40E+06	9.06E+06	8.69E+06
August	1.88E+07	1.96E+07	1.92E+07	1.34E+07	1.43E+07	1.37E+07	1.53E+07	1.69E+07	1.56E+07	8.29E+06	8.92E+06	8.58E+06
September	1.67E+07	1.99E+07	1.93E+07[d]	1.28E+07	1.49E+07	1.40E+07	1.46E+07	1.75E+07	1.68E+07[d]	8.20E+06	8.77E+06	8.52E+06

[a]Minimum equals minimum recorded daily average radon concentration.
[b]Maximum equal maximum recorded daily average radon concentration.
[c]Average equals monthly average of recorded daily radon concentrations.
[d]September 2000 average radon headspace concentration reflects data from September 1, 2000 through September 19, 2000.

TABLE 4-8

DIRECT RADIATION (TLD) MEASUREMENTS

Location	Third Quarter 2000 Results	2000 Summary Results[a]	1999 Summary Results
2	20	56	75
3	20	53	72
4	19	50	68
5	19	51	70
6	23	61	81
7	19	50	68
8A	20	53	74
9C	21	56	76
13	20	53	74
14	20	53	71
15	22	59	79
16	23	60	81
17	20	54	70[b]
34	21	55	76
35	20	52	71
36	18	48	64
37	22	58	76
38	18	47	63
39	22	59	79
40	18	49	68
41	**21**	55	72
Min.	**18**	**47**	**63**
Max.	**23**	**61**	**81**
On Site			
22	262	789	904
23A[c]	259	735	866[d]
24	200	589	707
25	233	660	881
26	193	473	547
32	15	42	55
Min.	**15**	**42**	**55**
Max.	**262**	**789**	**904**
Background			
18	NA[e]	52[f]	77
19	17	46	63
20	17	46	62
27	18	46	62
33	18	51	67
Min.	**17**	**46**	**62**
Max.	**18**	**52**	**77**

[a]2000 summary result value may not always agree with quarterly results due to rounding differences.
[b]Direct radiation value includes estimated second quarter results which were based on first quarter results.
[c]TLD location 23 was relocated to TLD location 23A on May 26, 1999.
[d]Direct radiation levels for TLD locations 23 and 23A were extrapolated.
[e]NA = not applicable
[f]Includes extrapolated third quarter results

FIGURE 4-1

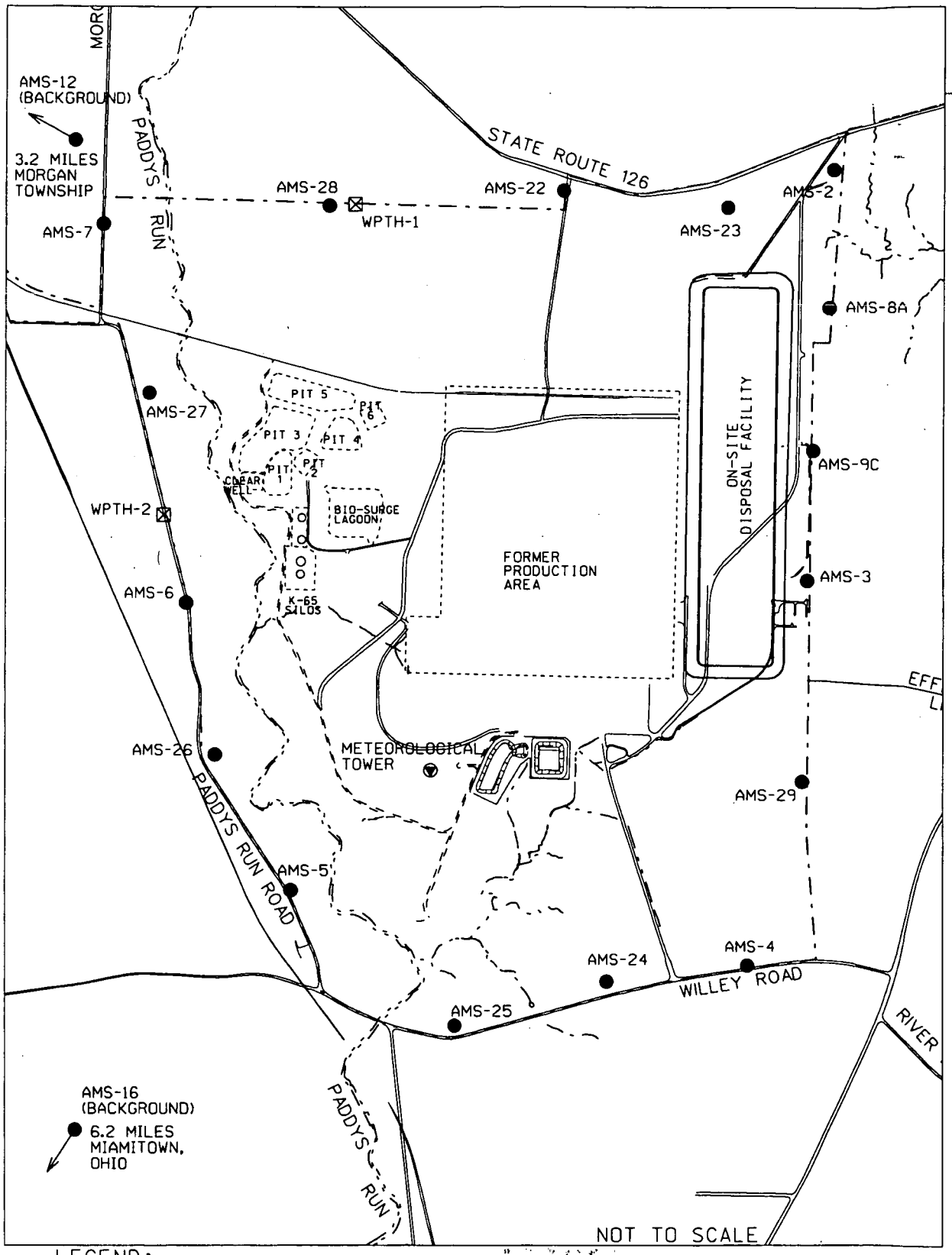
AIR SAMPLING ACTIVITIES[a]

SAMPLING ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Radiological Particulate Monitoring:							◆	◆	◆			
NESHAP Quarterly Composite									◆			
NESHAP Stack Emissions Monitoring							◆	◆	◆			
Radon Monitoring – Continuous Alpha Scintillation Monitors							◆	◆	◆			
Direct Radiation (TLD) Monitoring									◆			

◆ Data summarized/evaluated in this report

FINAL

[a]Future data will be reported through the IEMP Extranet Site and quarterly summaries.



LEGEND:

- FEMP BOUNDARY
- AMS LOCATION
- DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO AMS LOCATION OFF MAP
- THORIUM MONITOR LOCATION

FINAL

000110

FIGURE 4-2. IEMP AIR MONITORING LOCATIONS

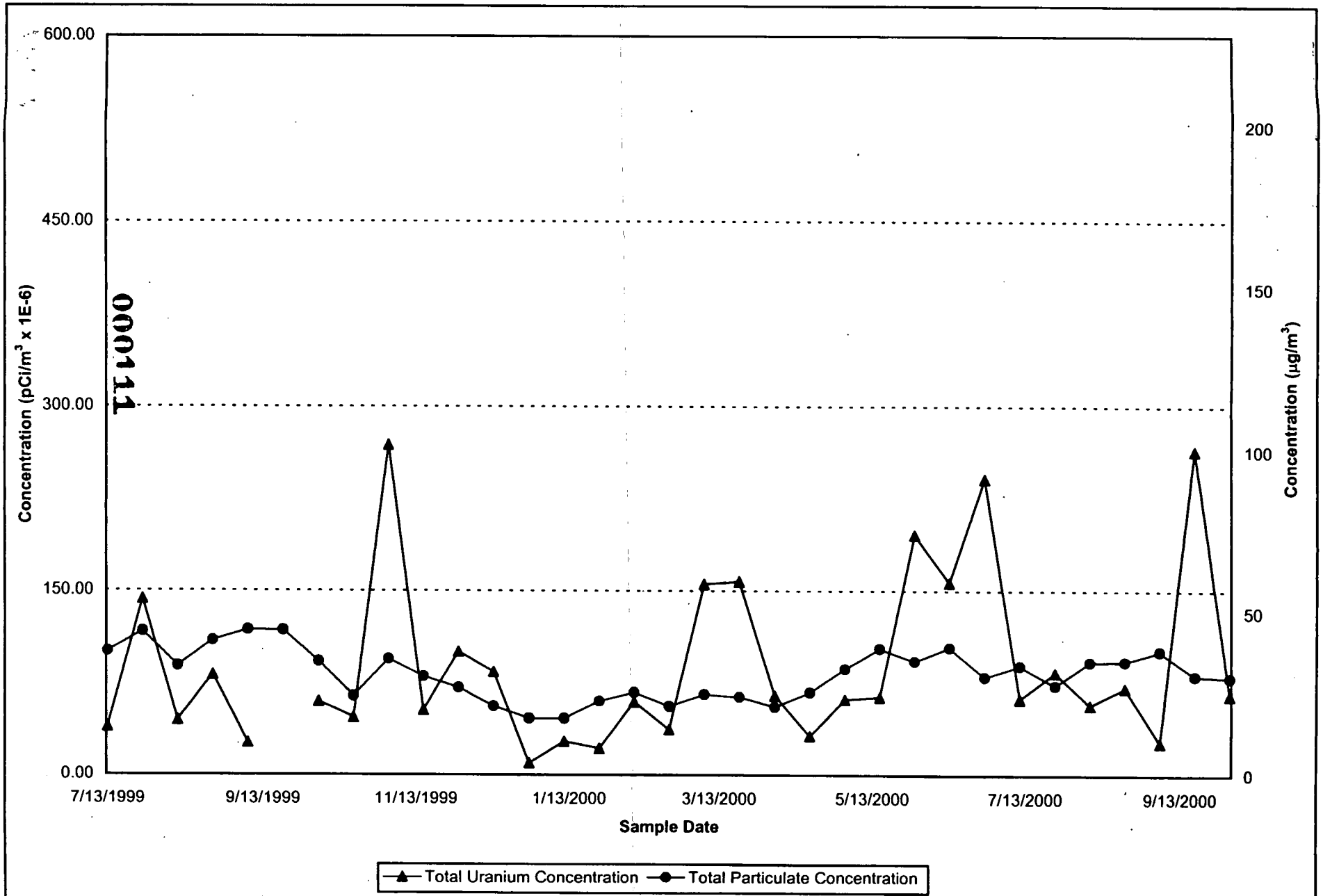


FIGURE 4-3. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-2)

FINAL

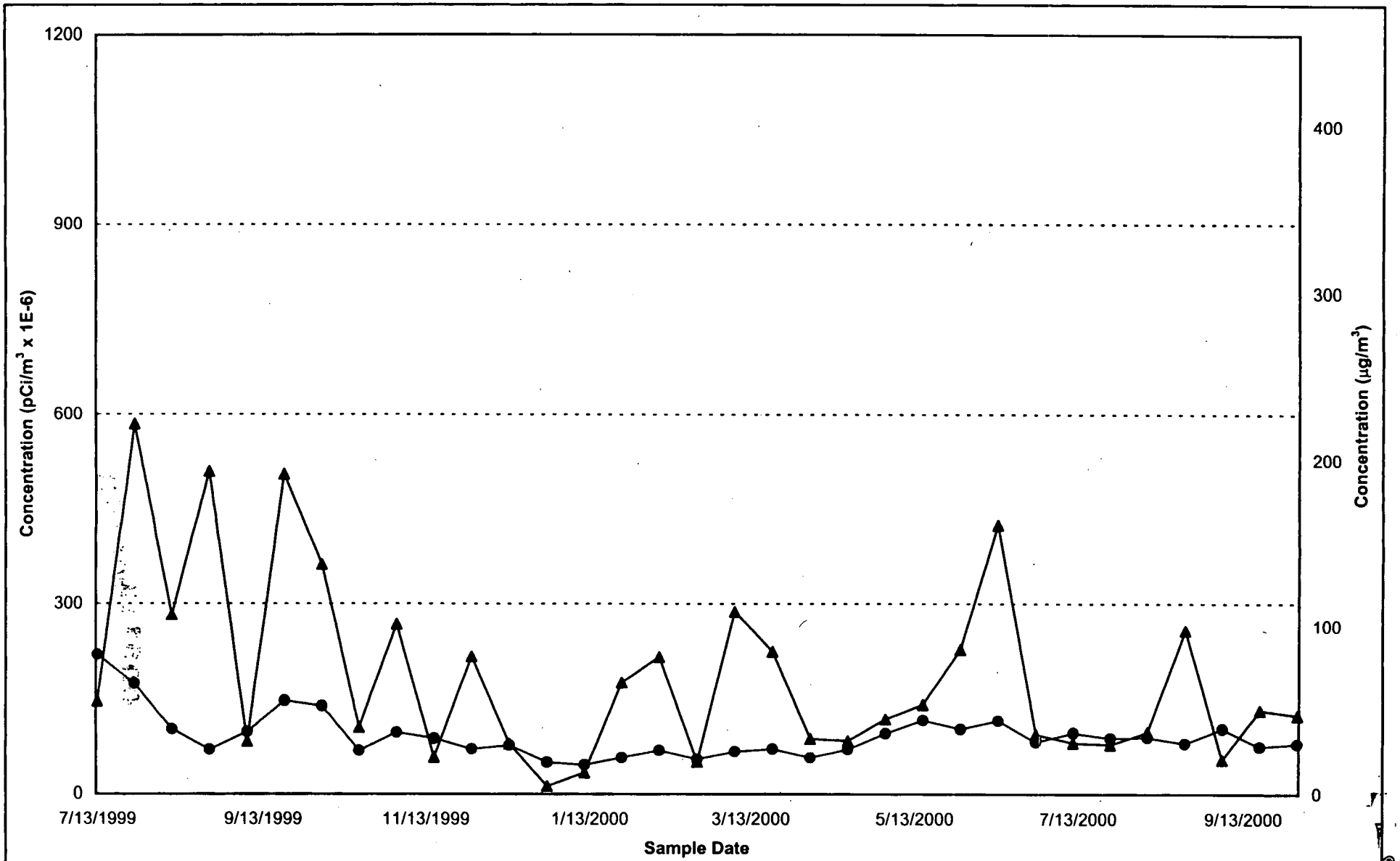


FIGURE 4-4. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-3)

FINAL

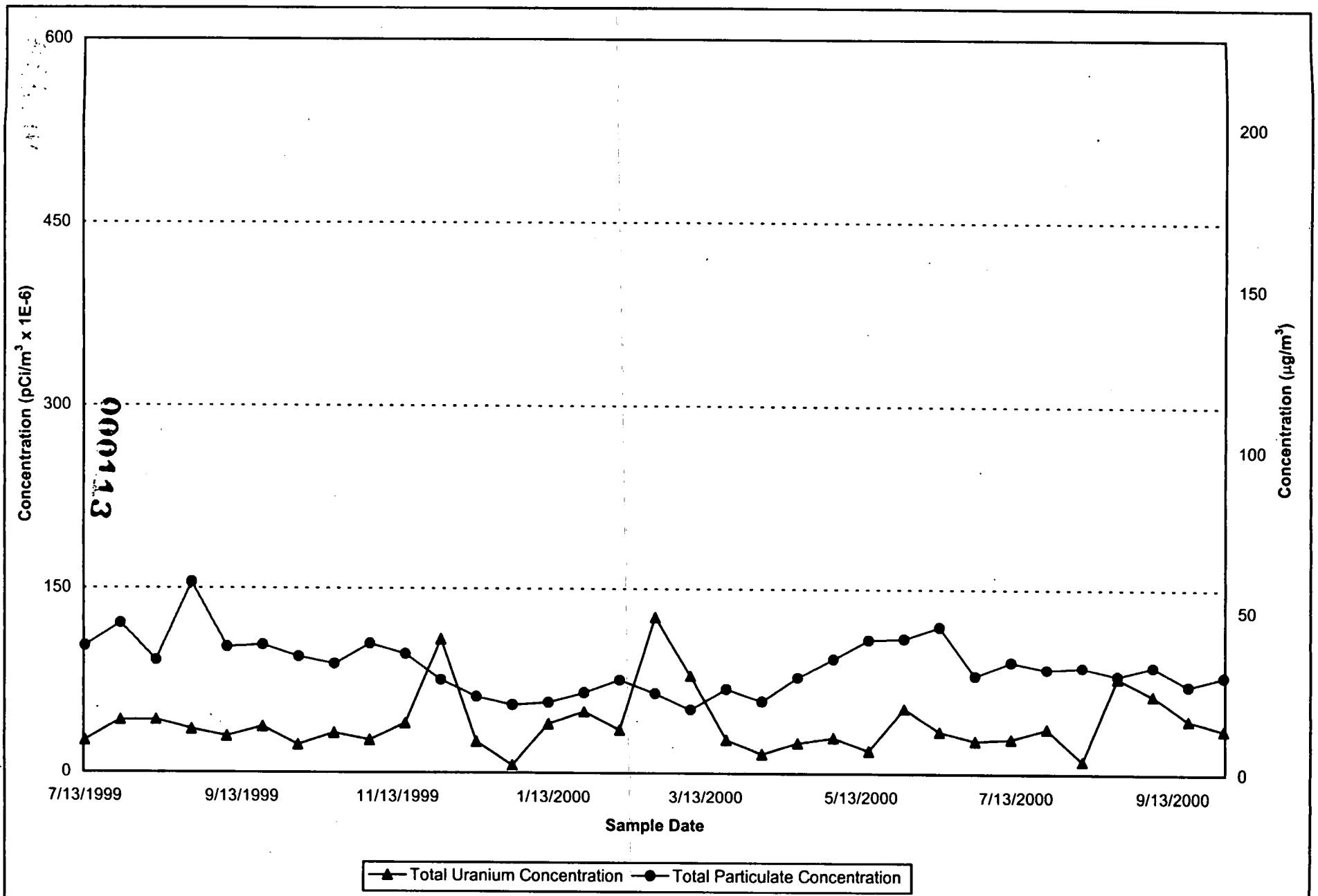


FIGURE 4-5. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-4)

FINAL

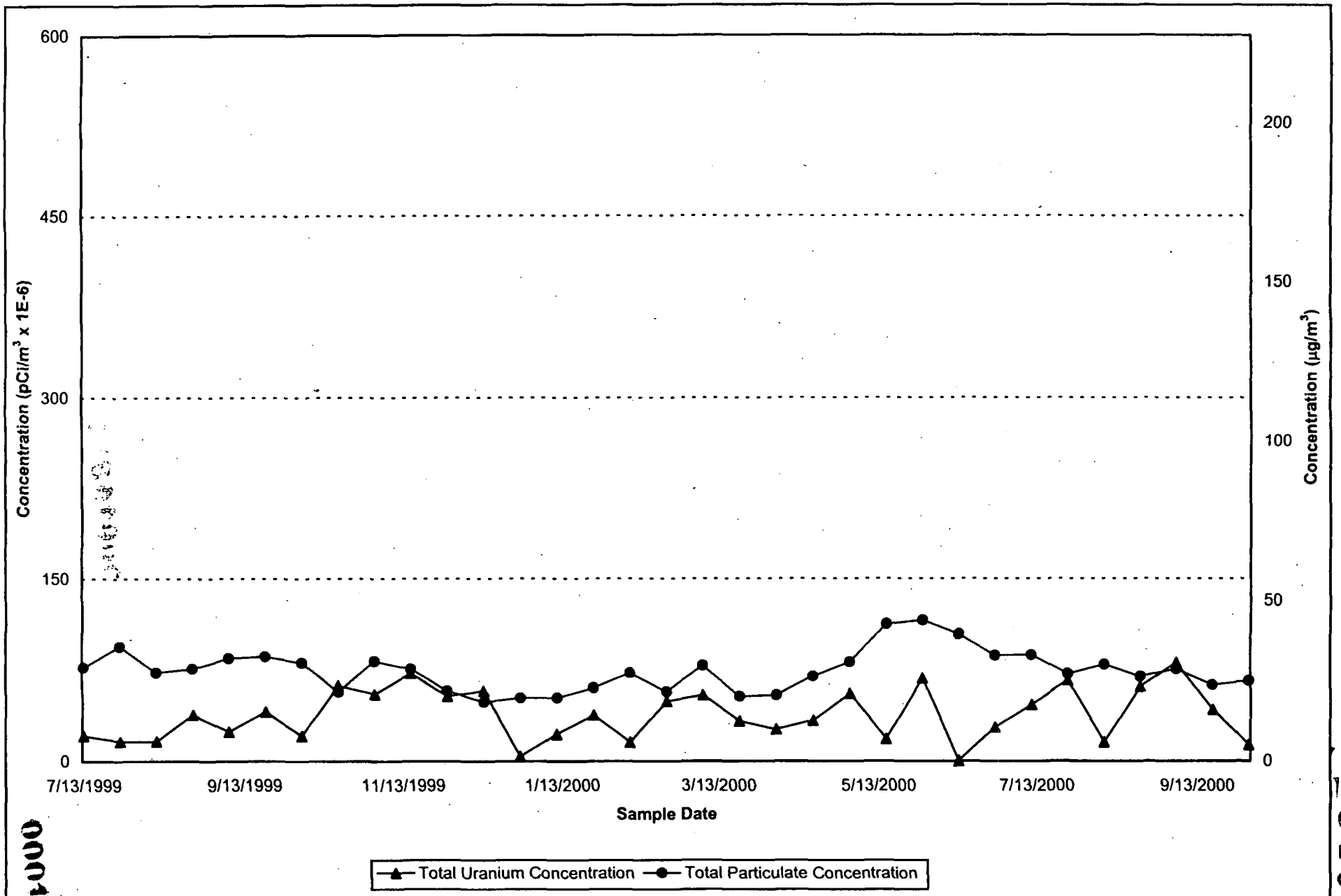


FIGURE 4-6. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-5)

FINAL

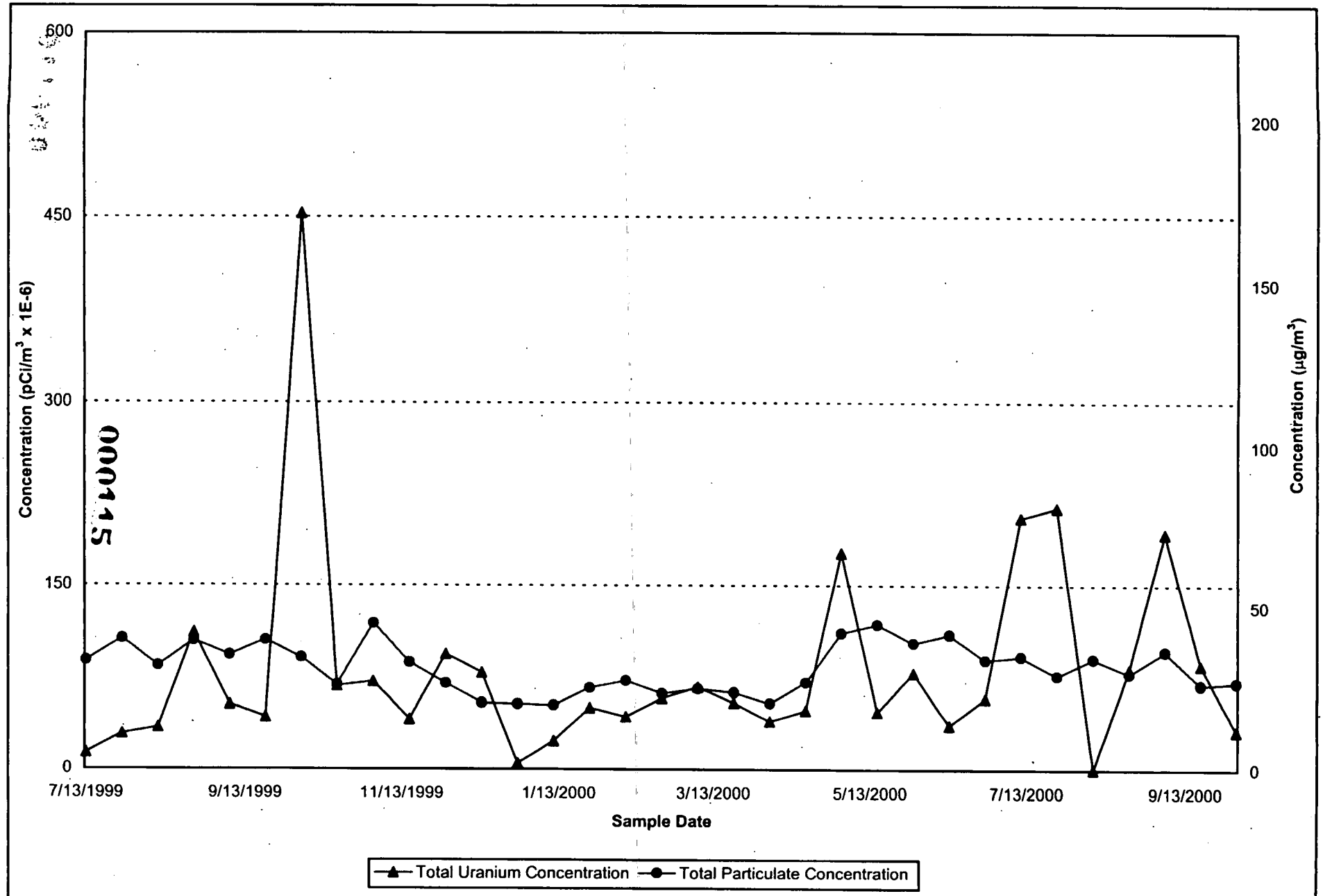


FIGURE 4-7. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-6)

FINAL

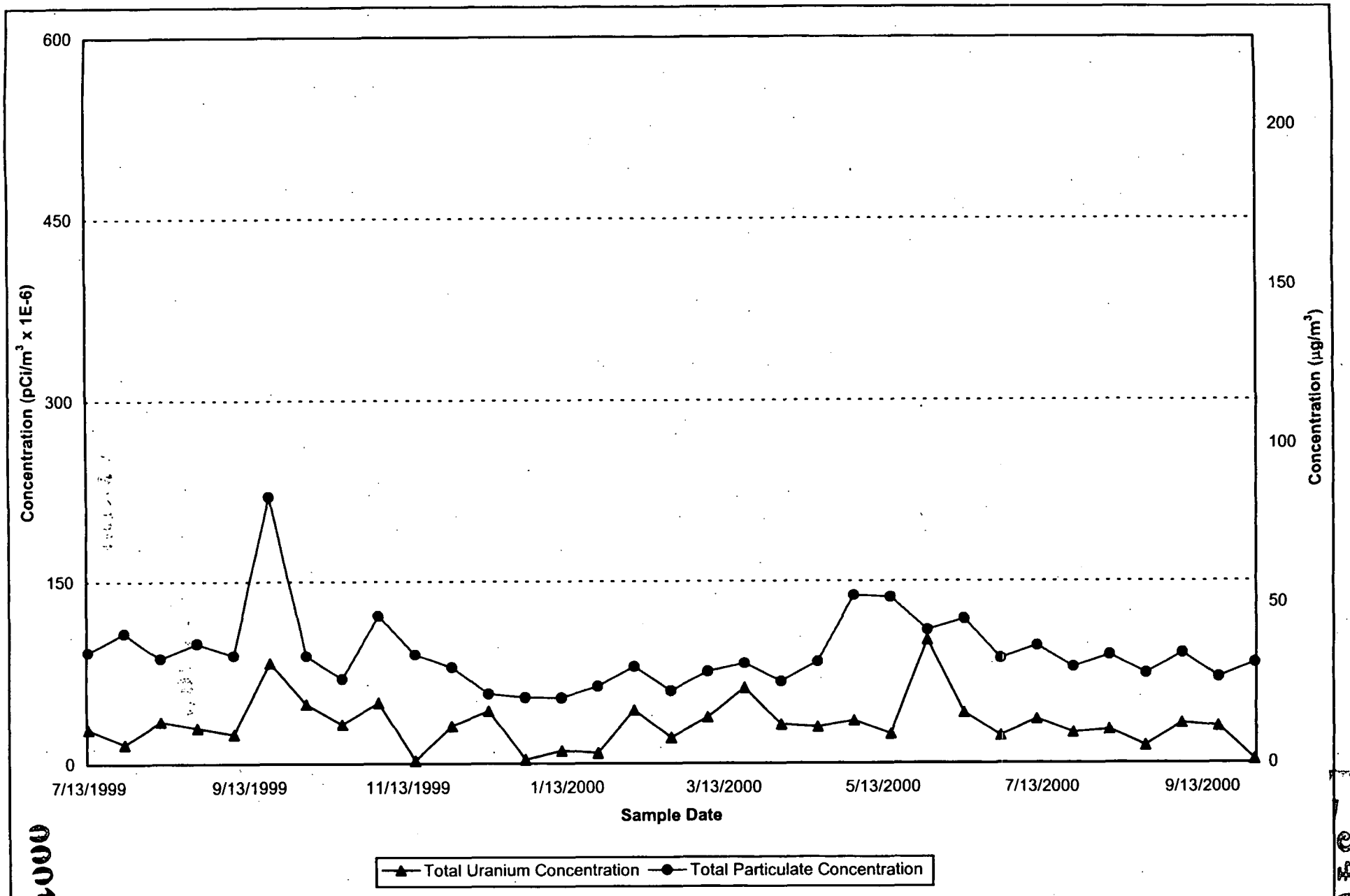


FIGURE 4-8. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-7)

FINAL

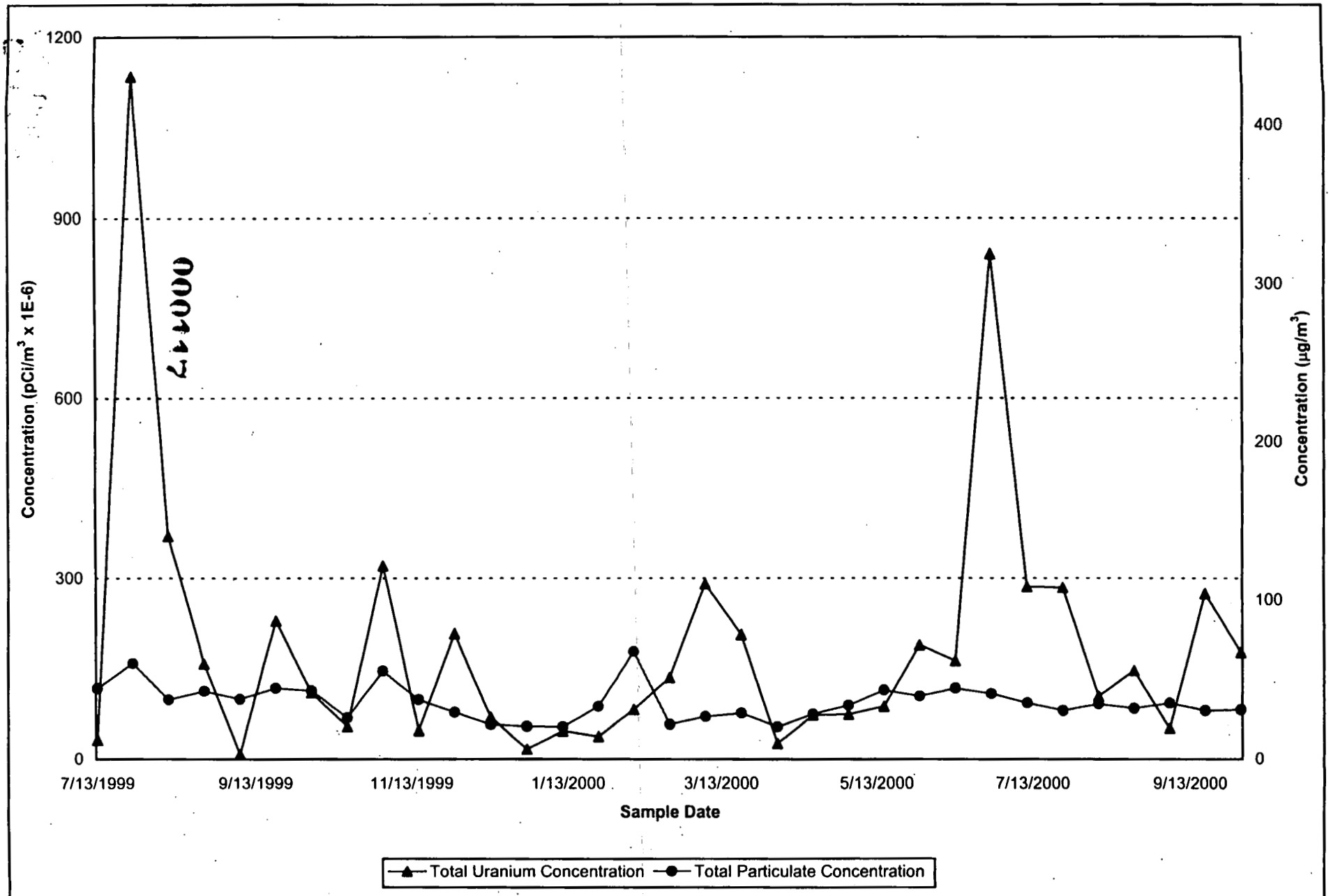


FIGURE 4-9. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-8A)

FINAL

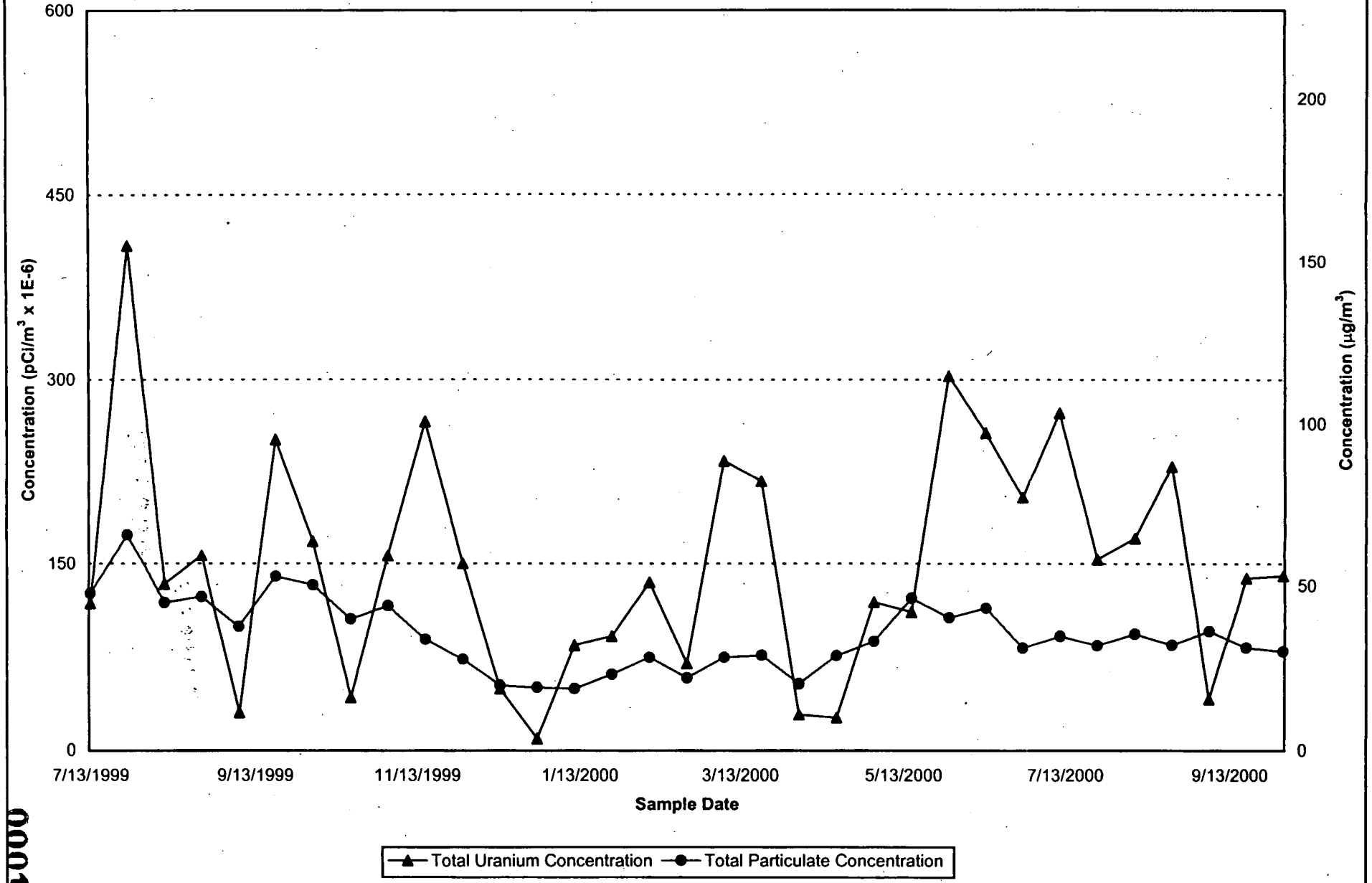


FIGURE 4-10. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-9C)

FINAL

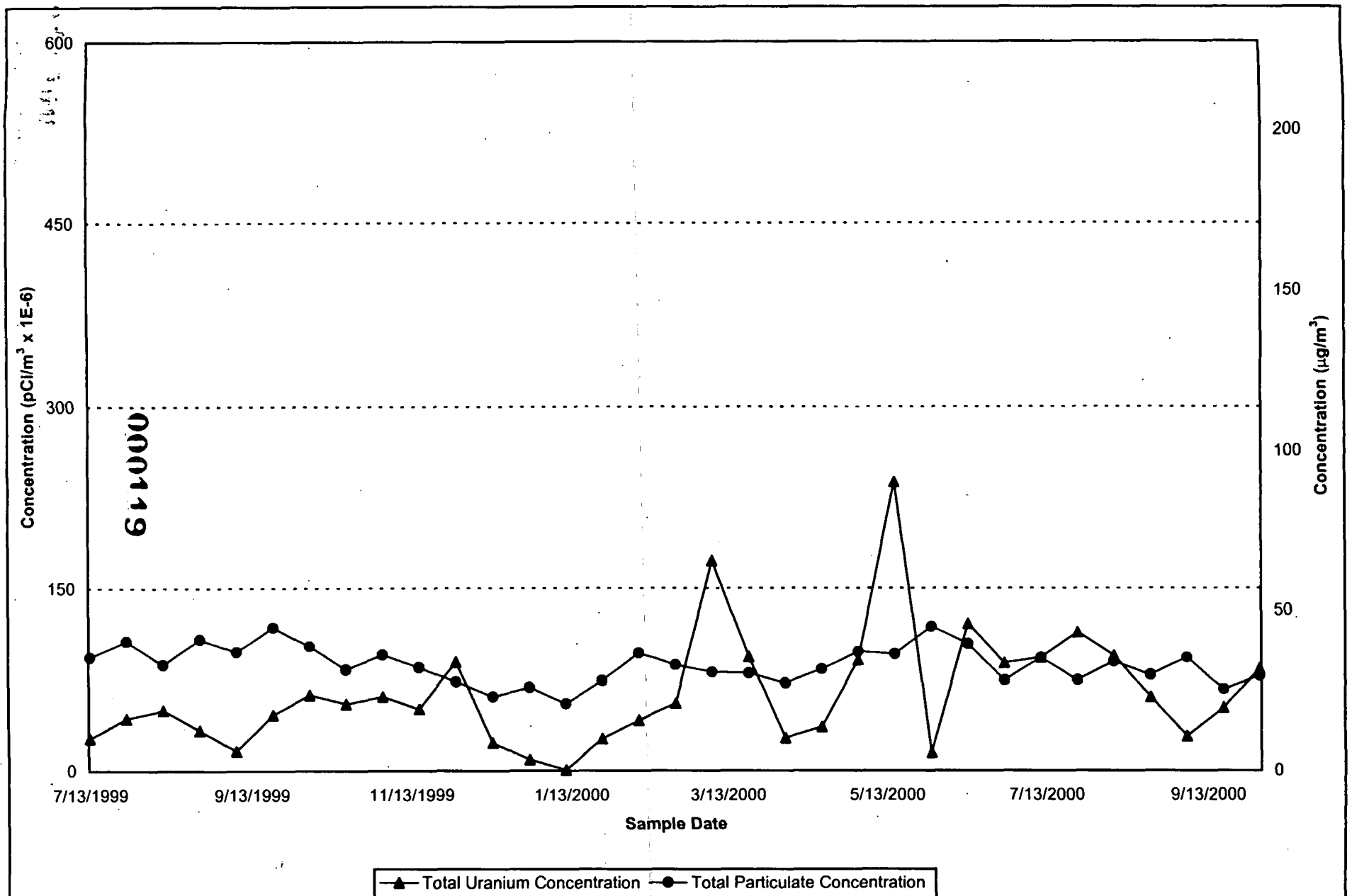


FIGURE 4-11. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-22)

FINAL

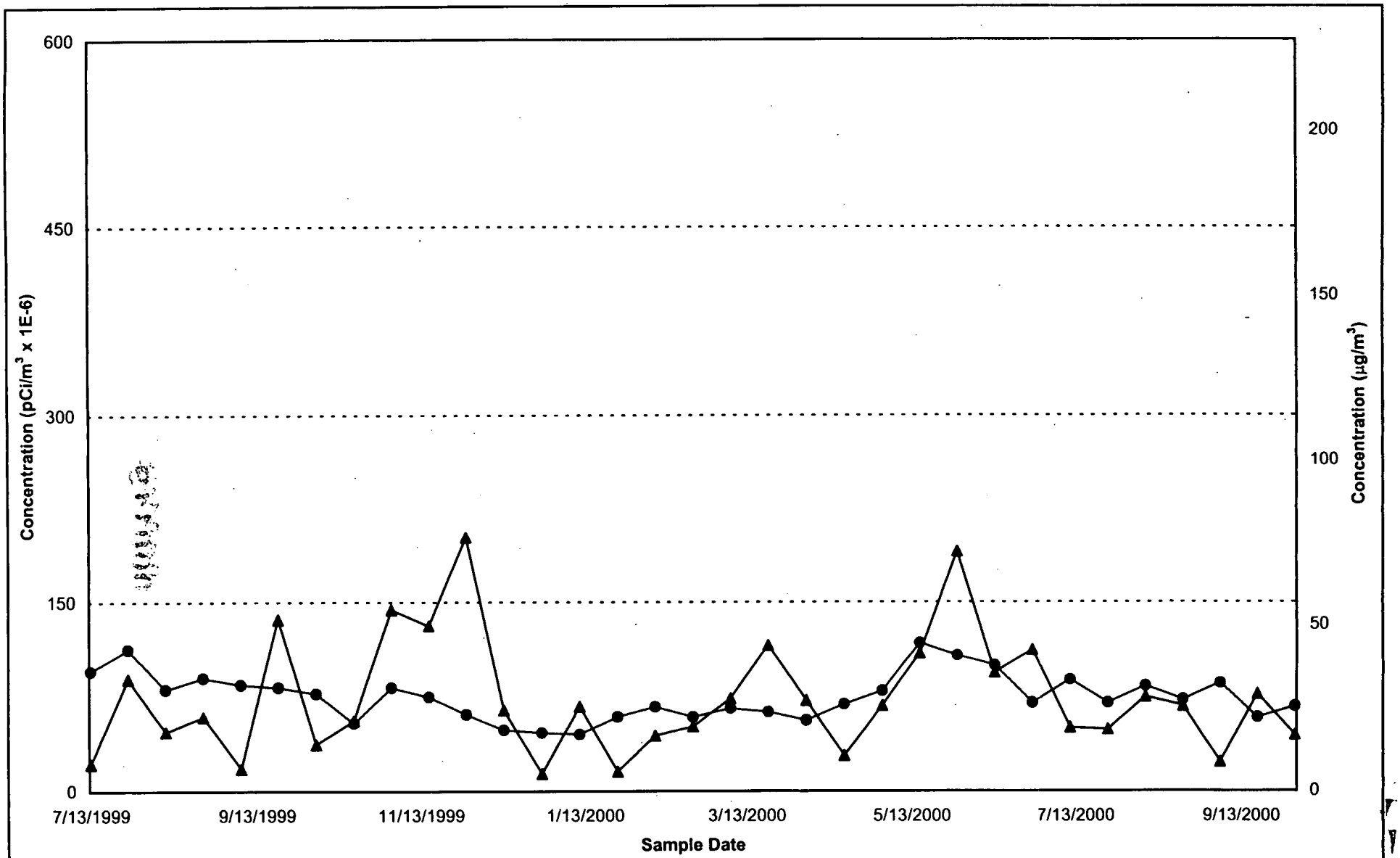


FIGURE 4-12. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-23)

FINAL

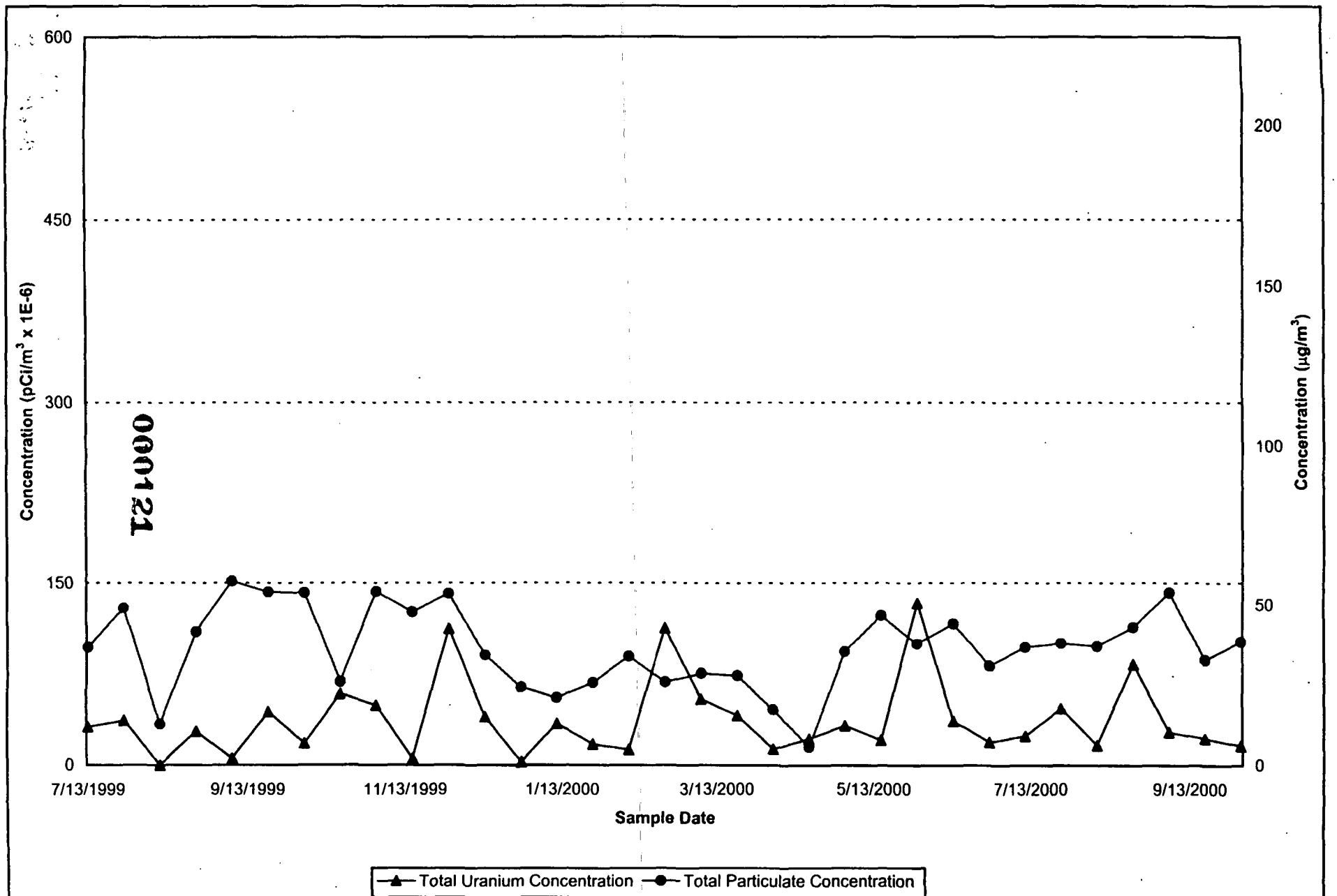


FIGURE 4-13. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-24)

FINAL

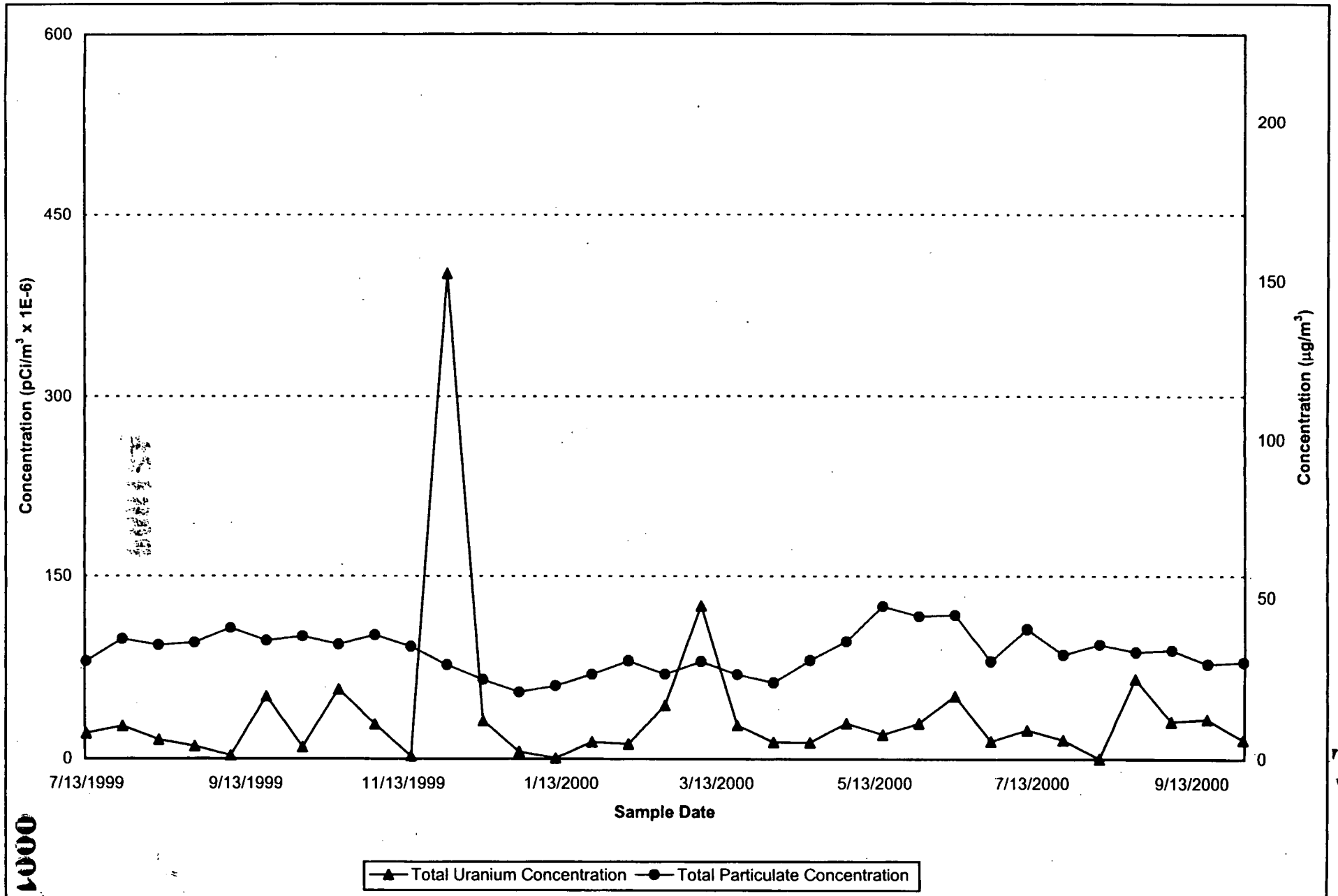


FIGURE 4-14. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-25)

FINAL

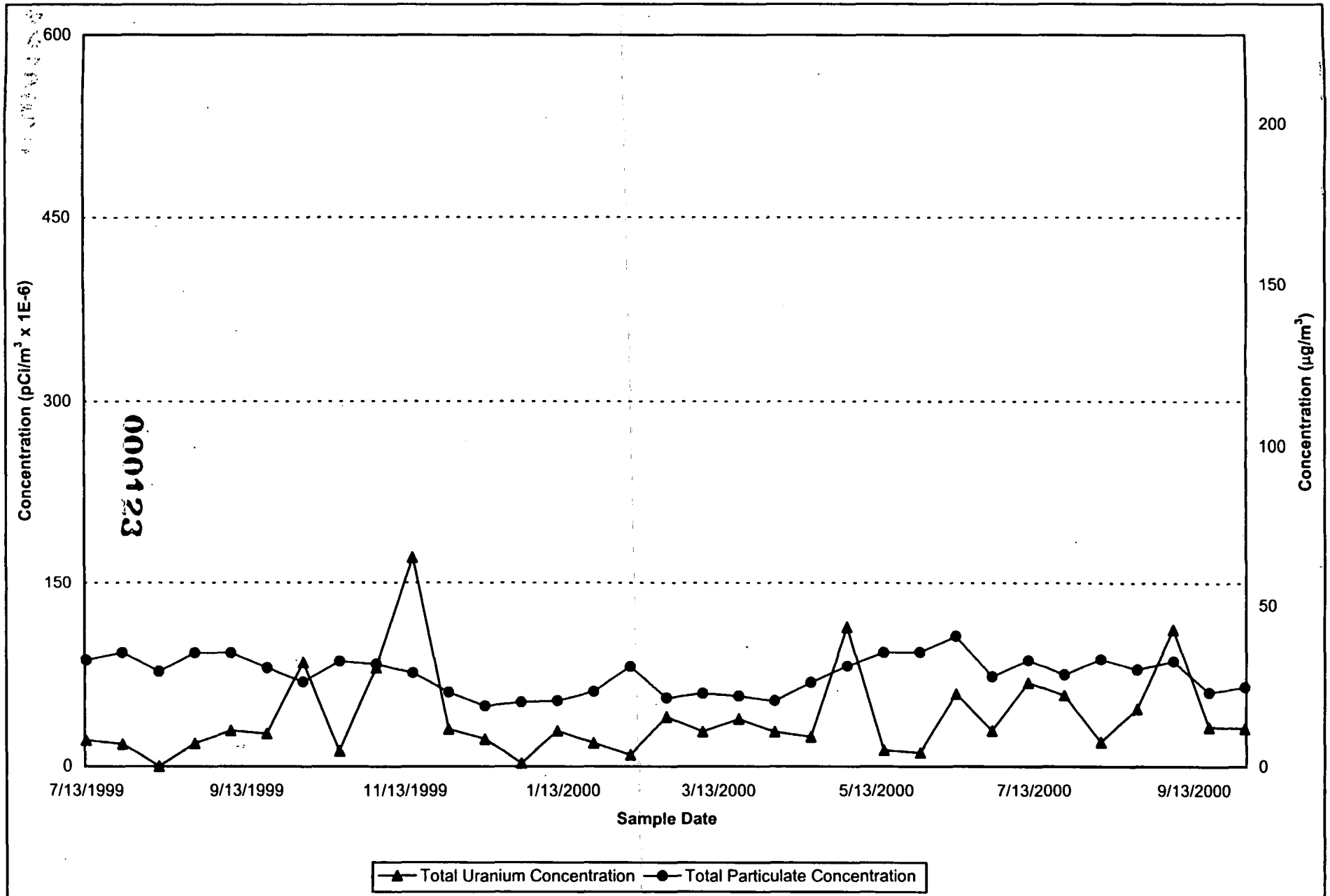


FIGURE 4-15. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-26)

FINAL

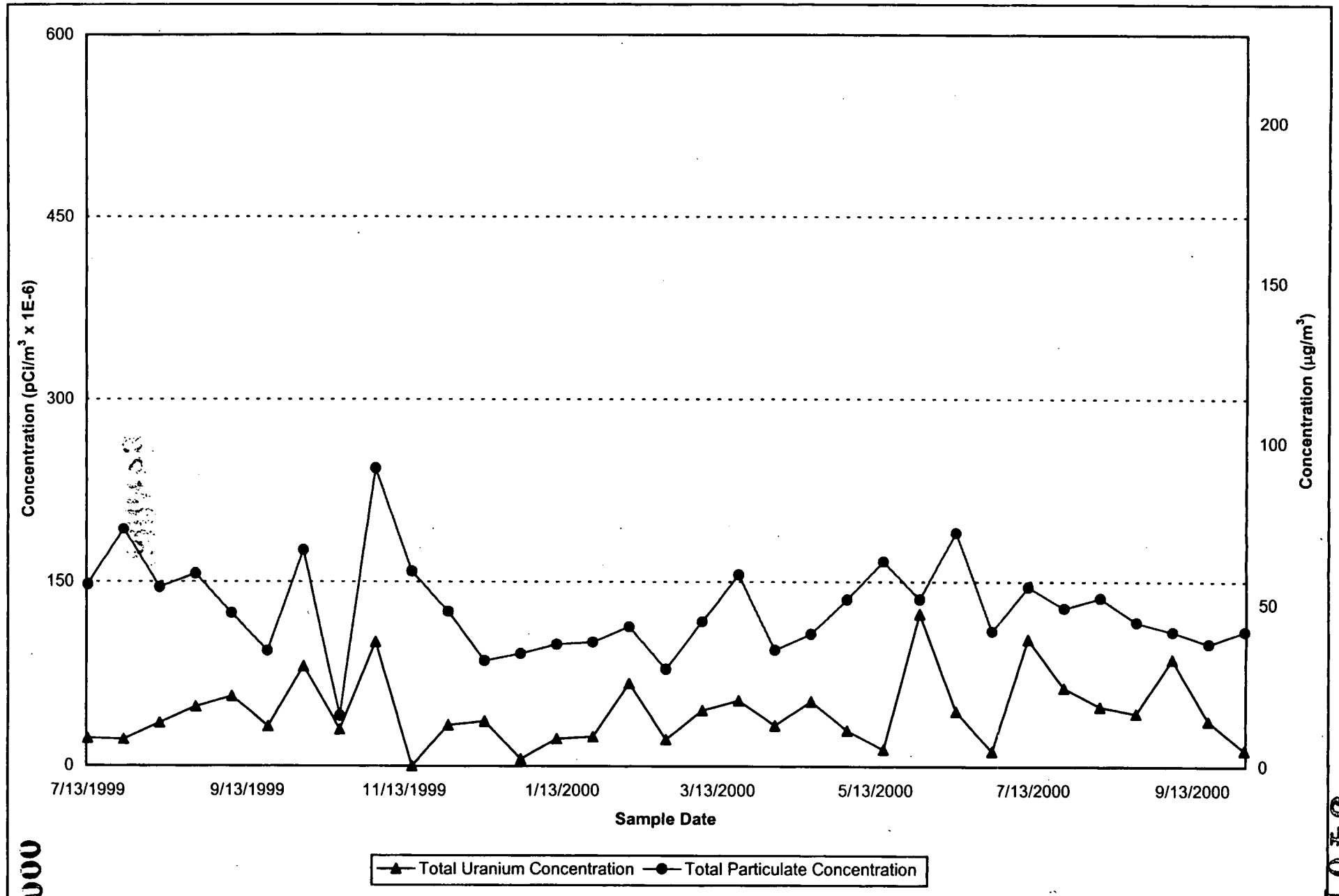


FIGURE 4-16. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-27)

FINAL

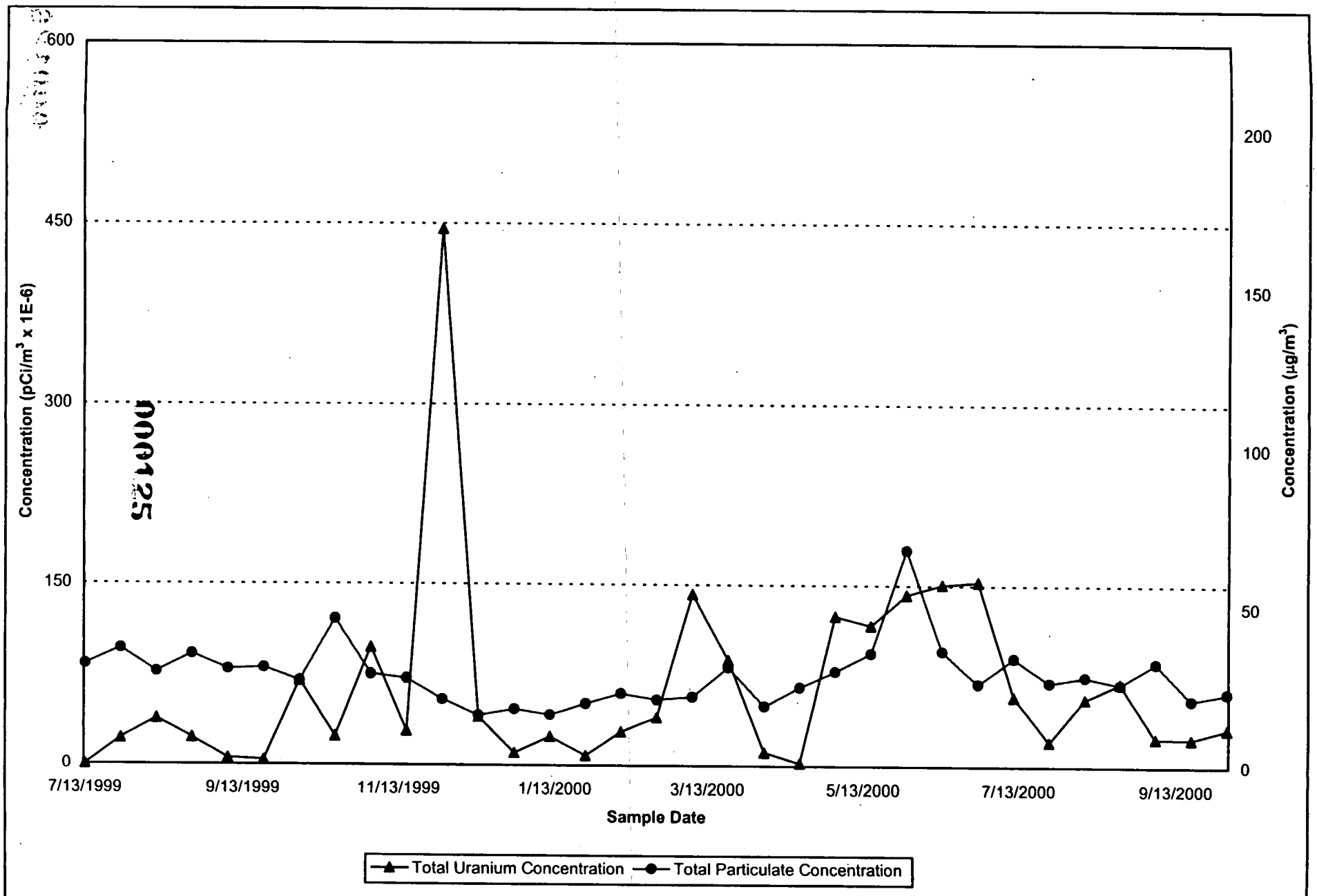


FIGURE 4-17. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-28)

FINAL

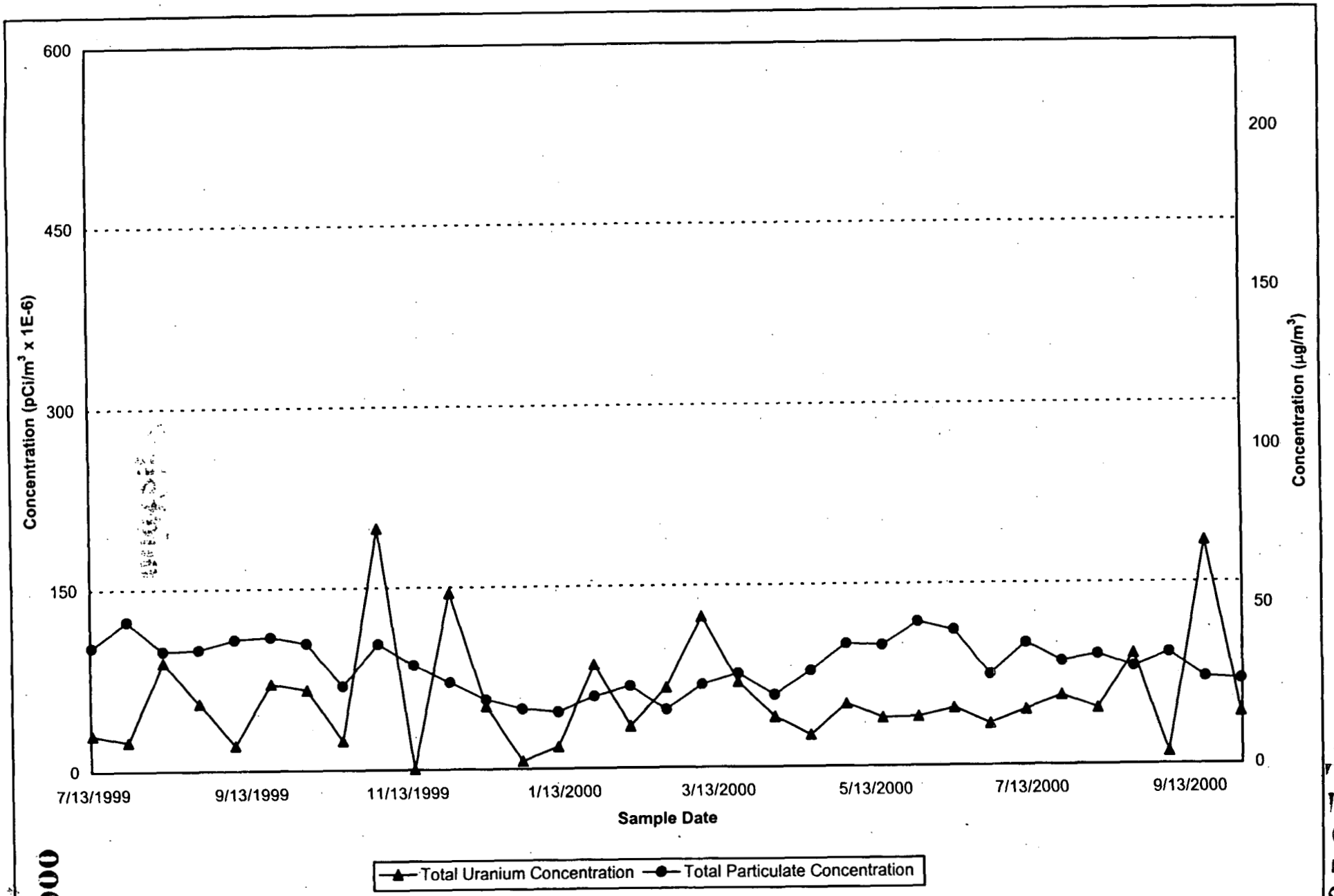


FIGURE 4-18. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-29)

FINAL

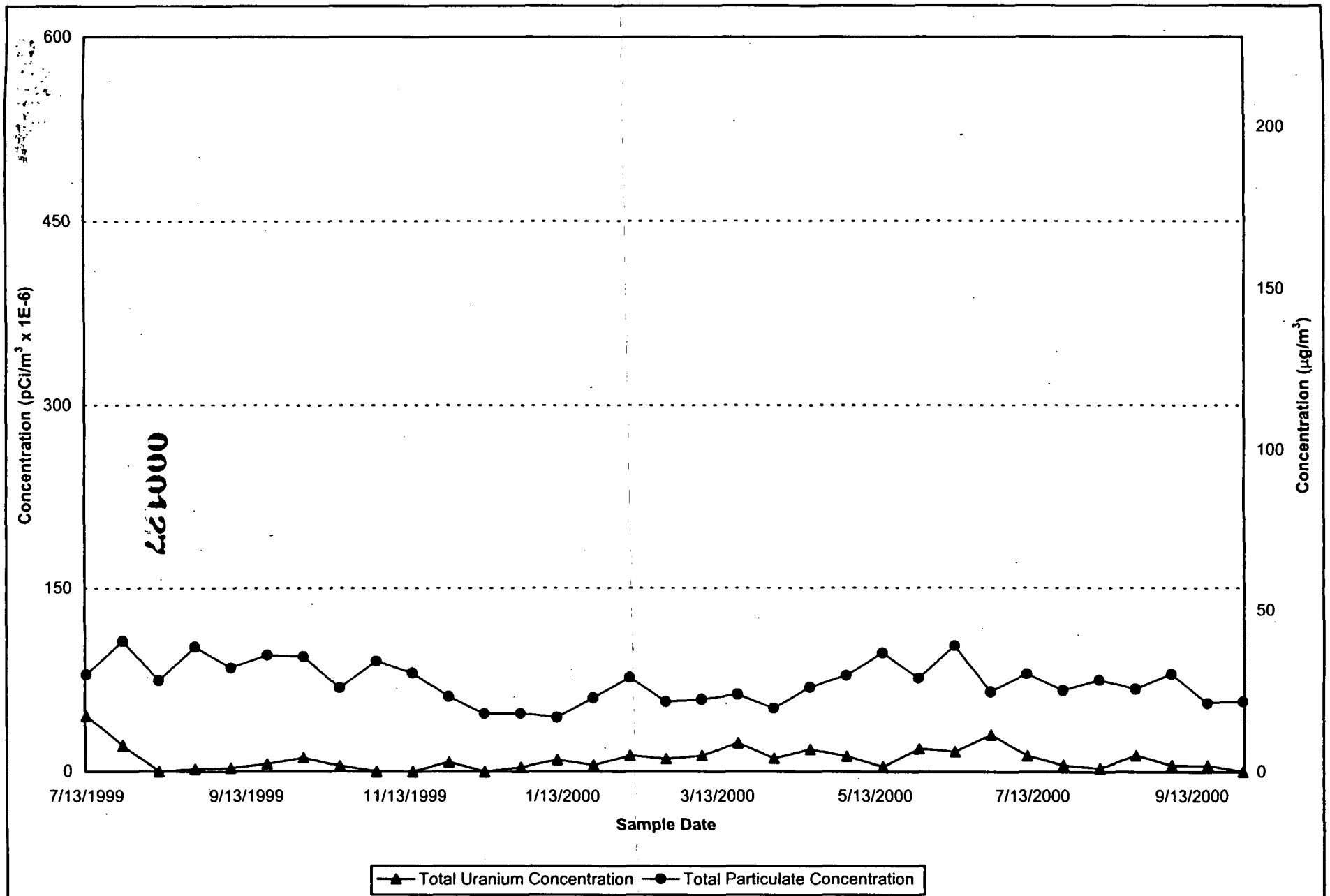


FIGURE 4-19. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-12)

FINAL

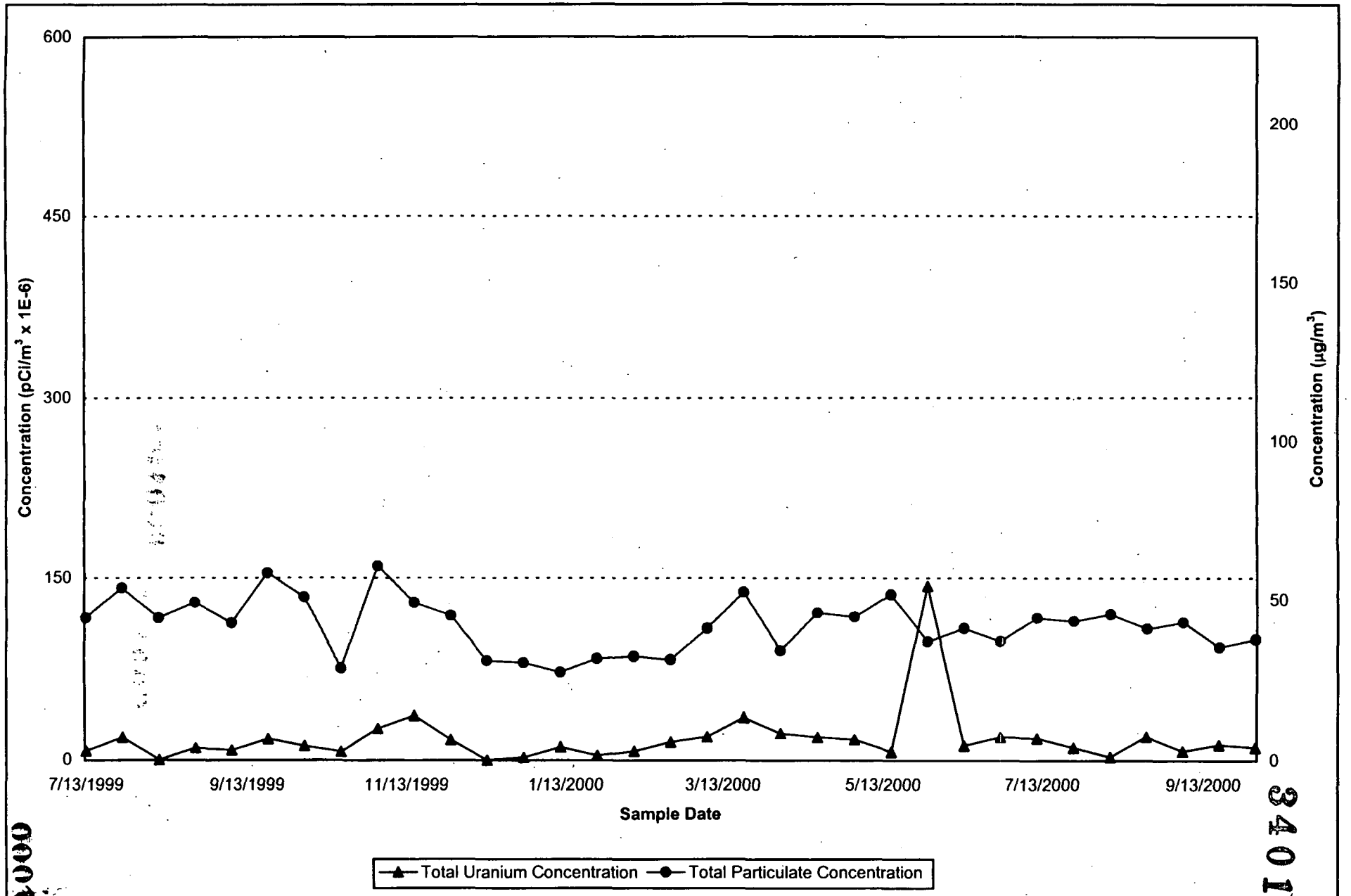


FIGURE 4-20. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-16)

FINAL

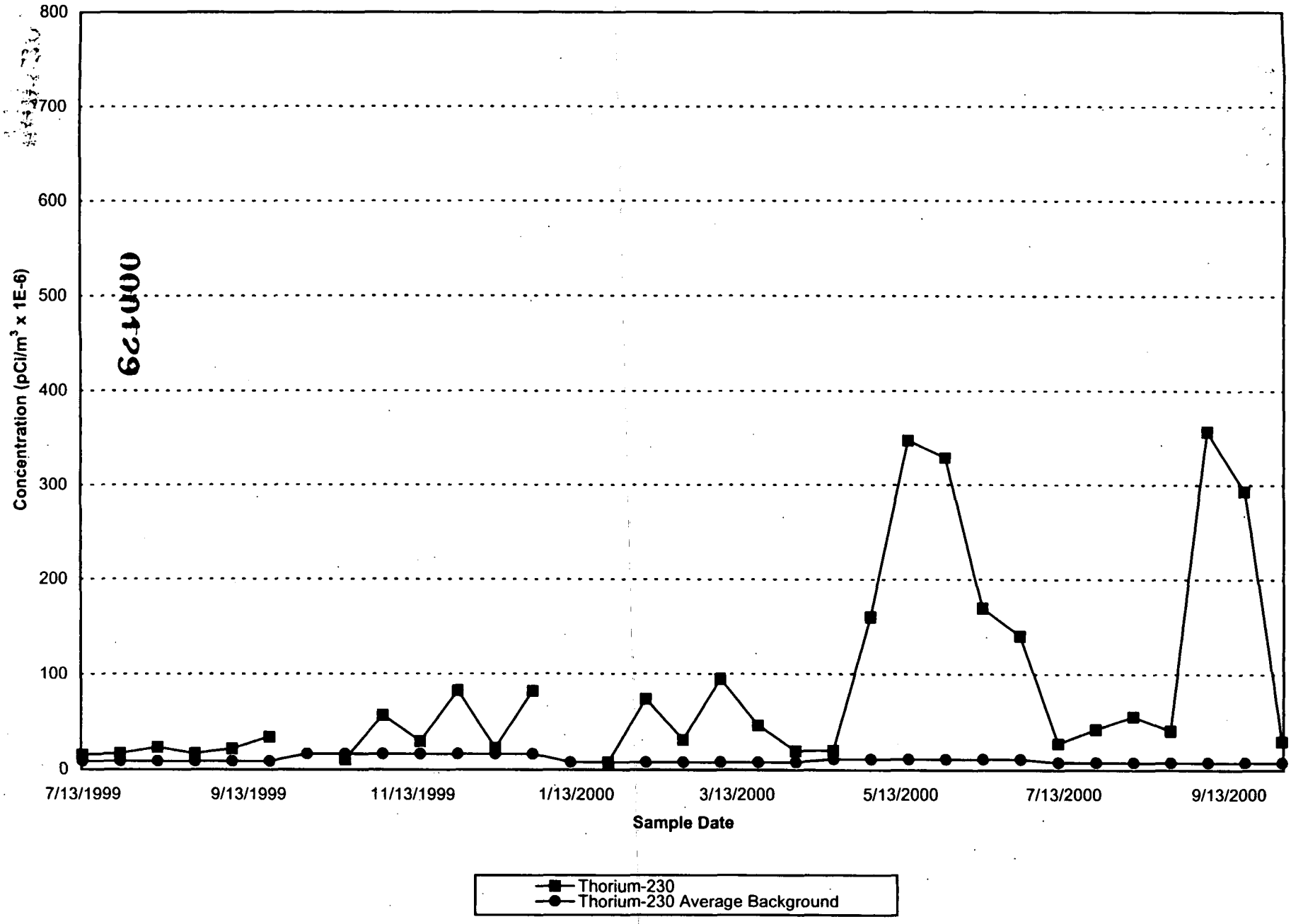


FIGURE 4-21. THORIUM-230 CONCENTRATIONS IN AIR (WPTH-1)

FINAL

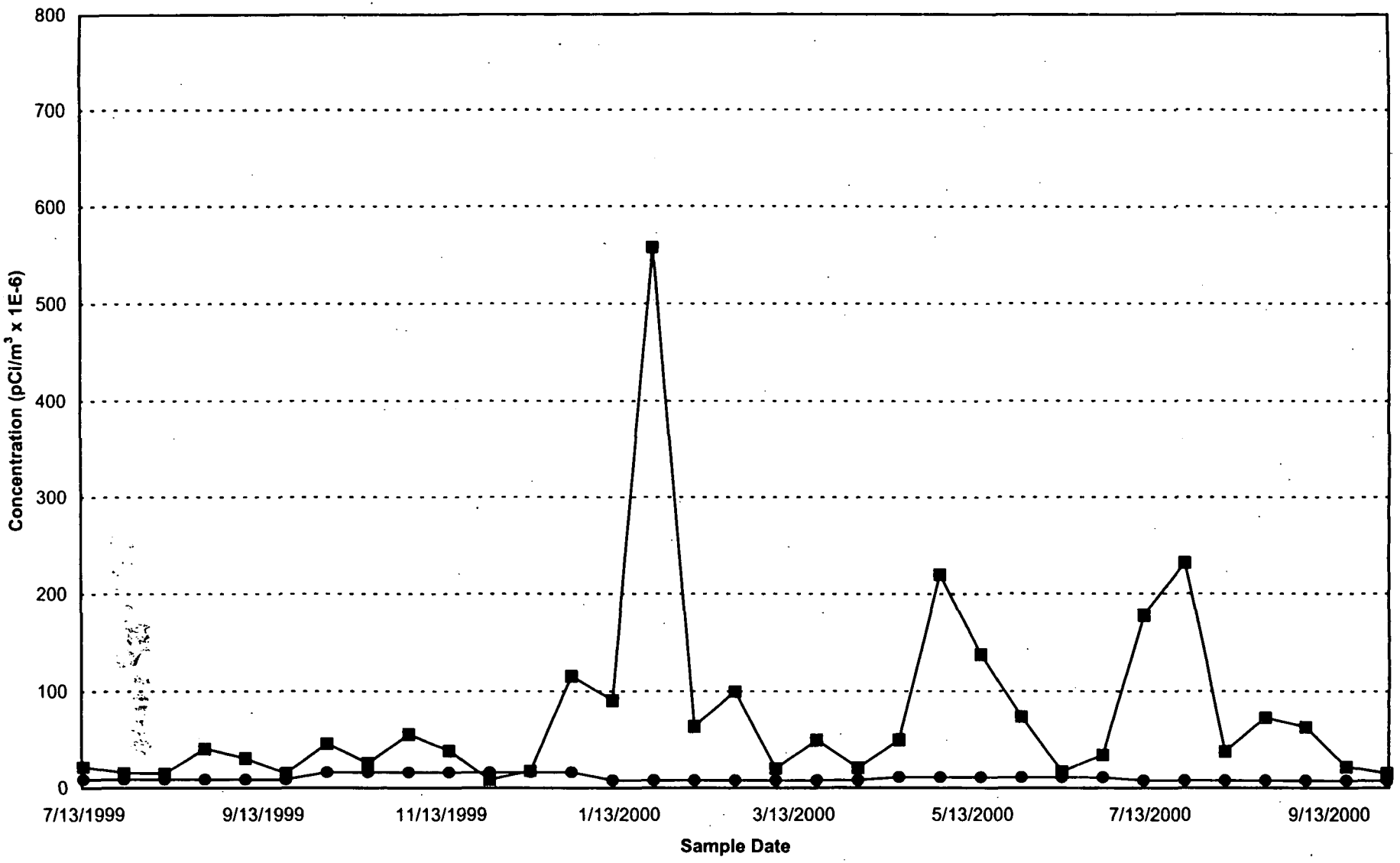


FIGURE 4-22. THORIUM-230 CONCENTRATIONS IN AIR (WPTH-2)

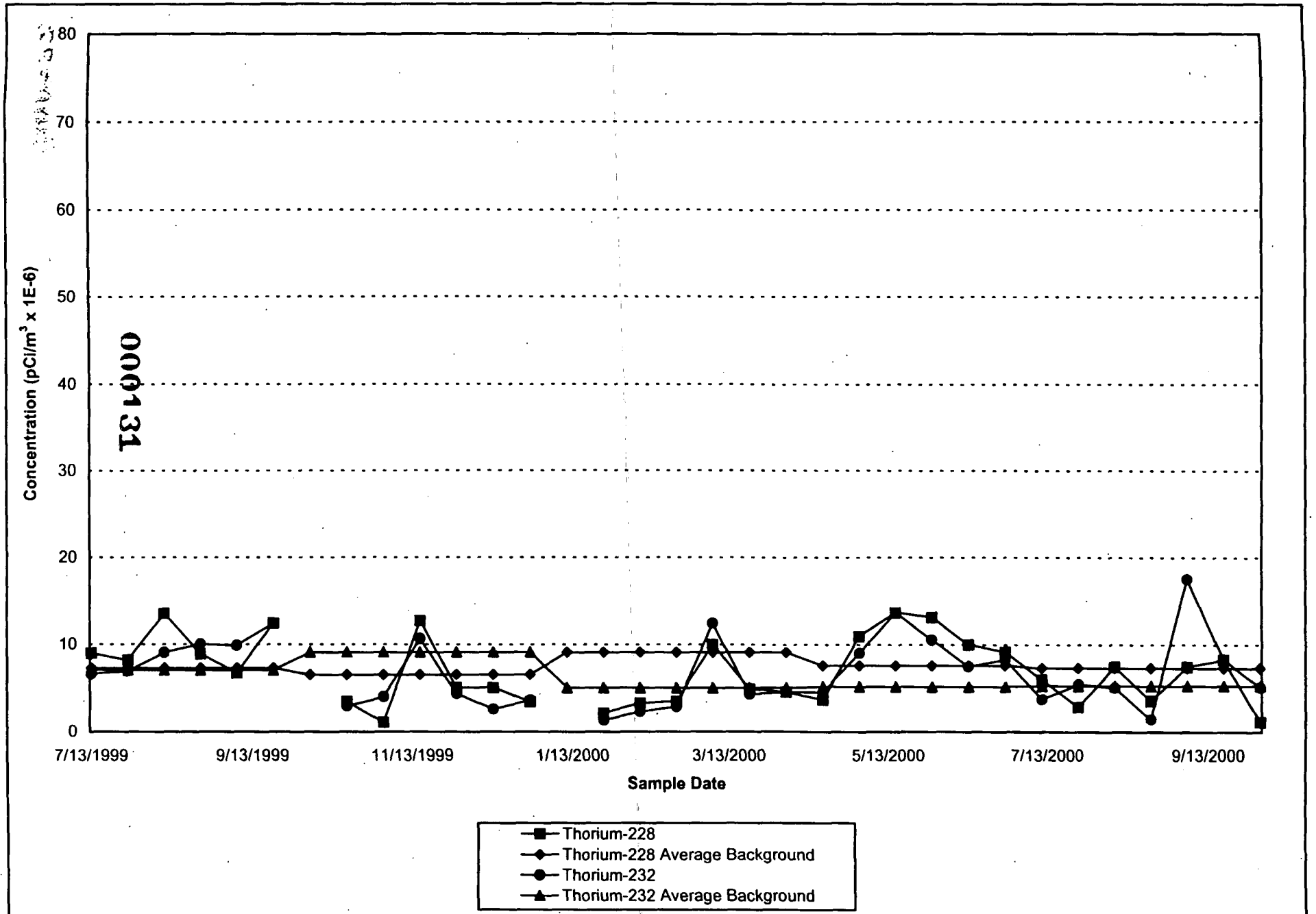


FIGURE 4-23. THORIUM-228 AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-1)

FINAL

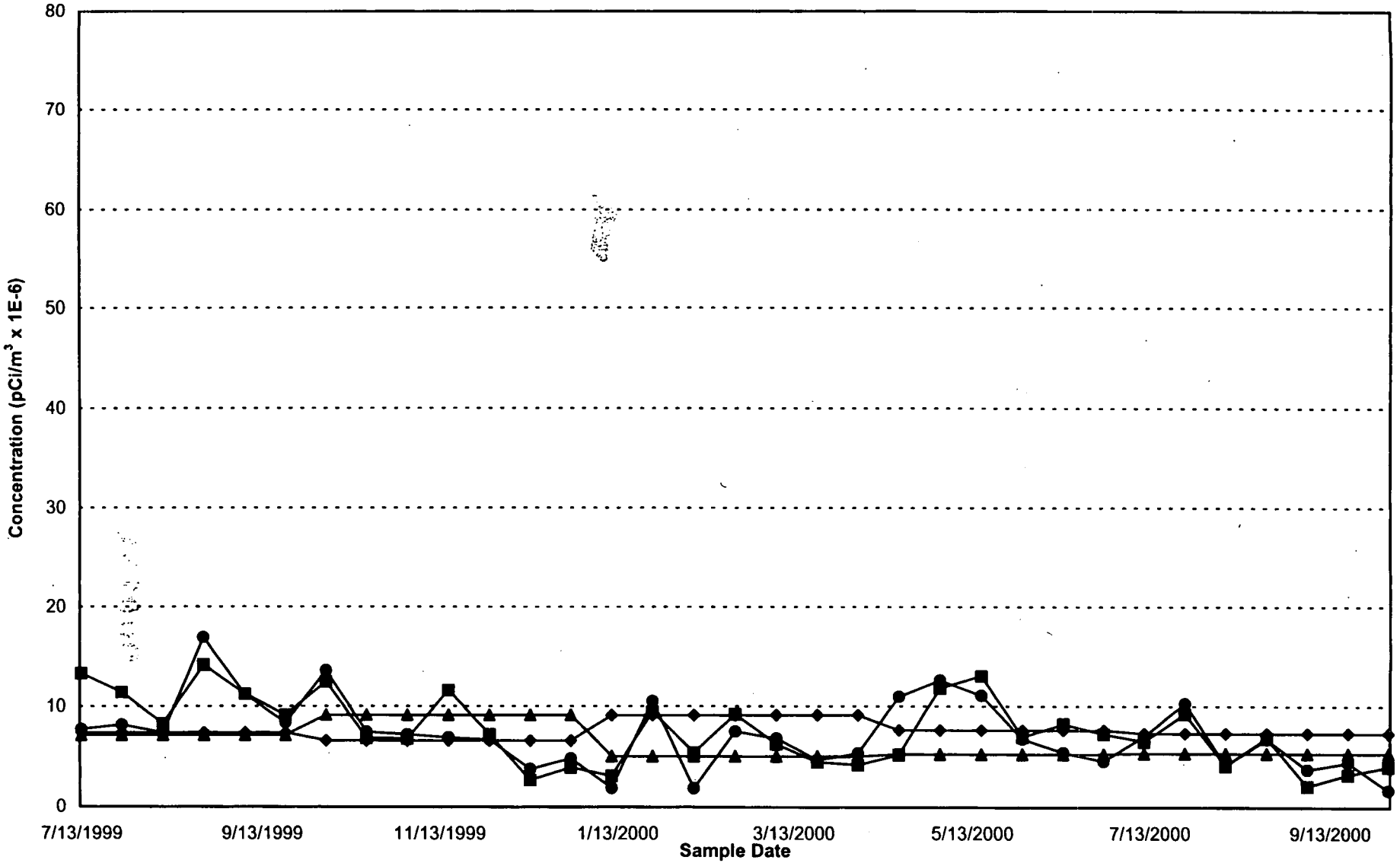
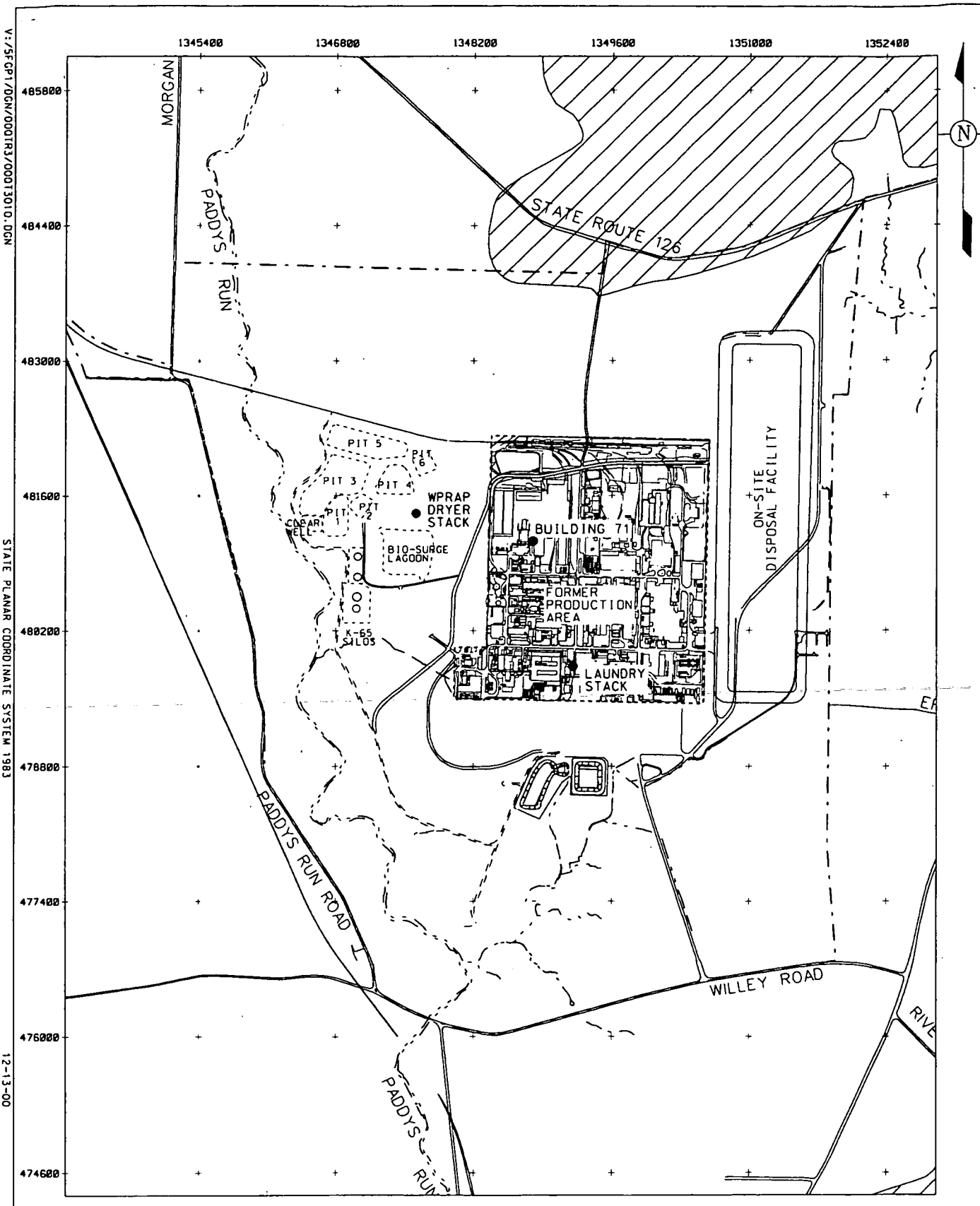


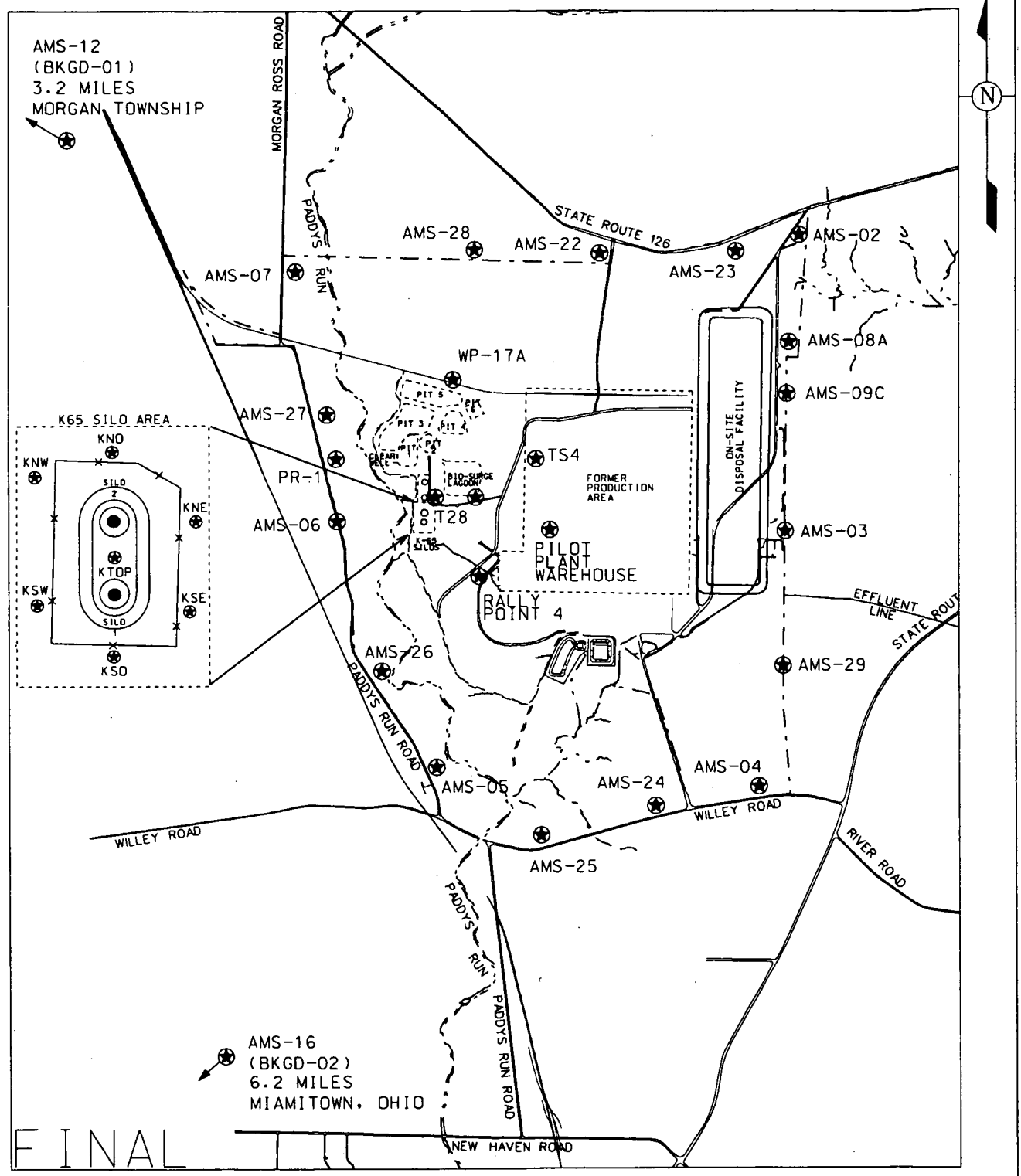
FIGURE 4-24. THORIUM-228 AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-2)



000133

FINAL

FIGURE 4-25. NESHAP STACK EMISSION MONITORING LOCATIONS



LEGEND:

— · — · — FEMP BOUNDARY

⊛ ENVIRONMENTAL RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

⊛ DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP

● SILO HEAD SPACE RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

SCALE

2000 1000 0 2000 FEET

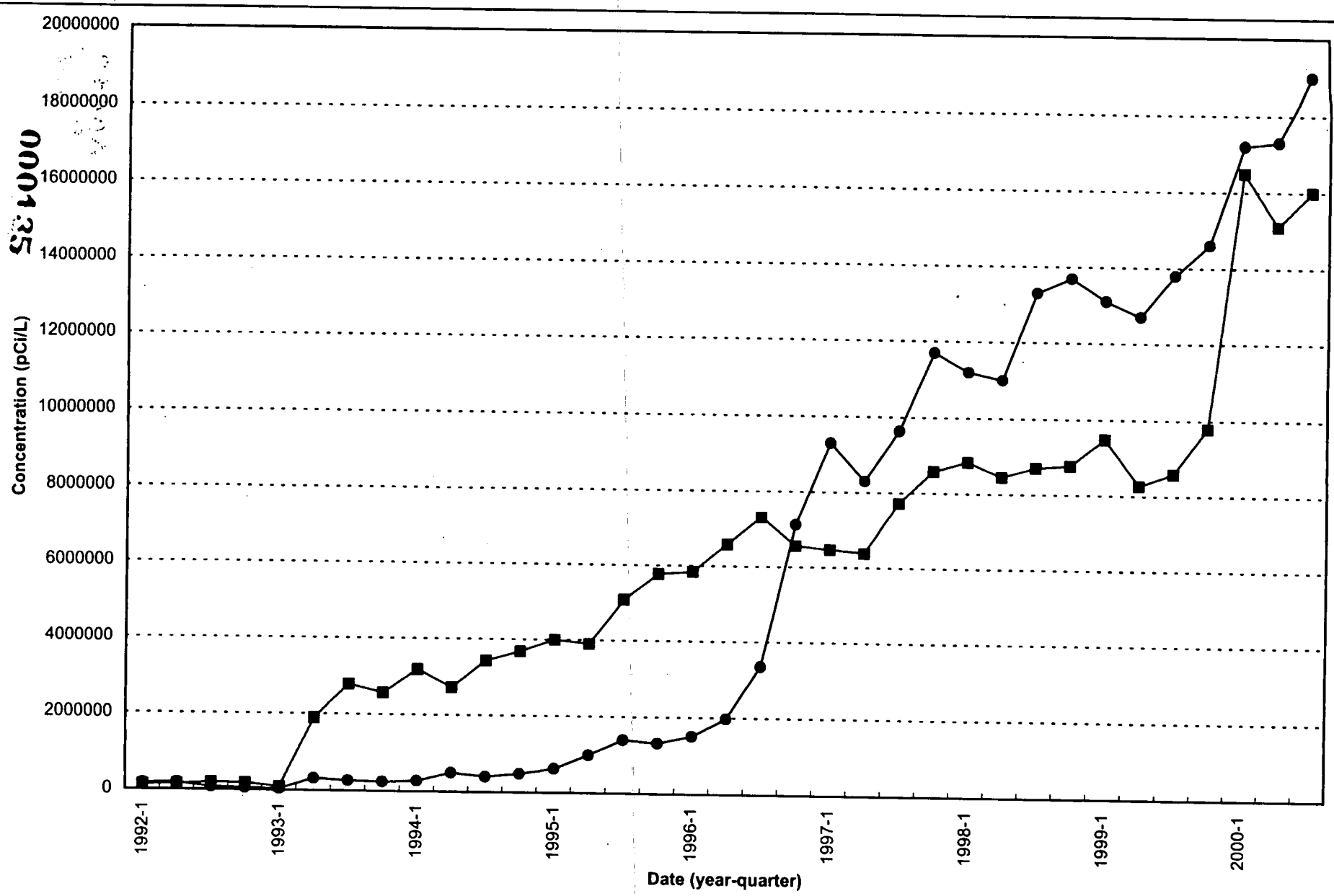
000134

FIGURE 4-26. RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATIONS

V:\SFGP1\DGN\0001R3\0001R3009.DGN

STATE PLANAR COORDINATE SYSTEM 1983

12-13-00

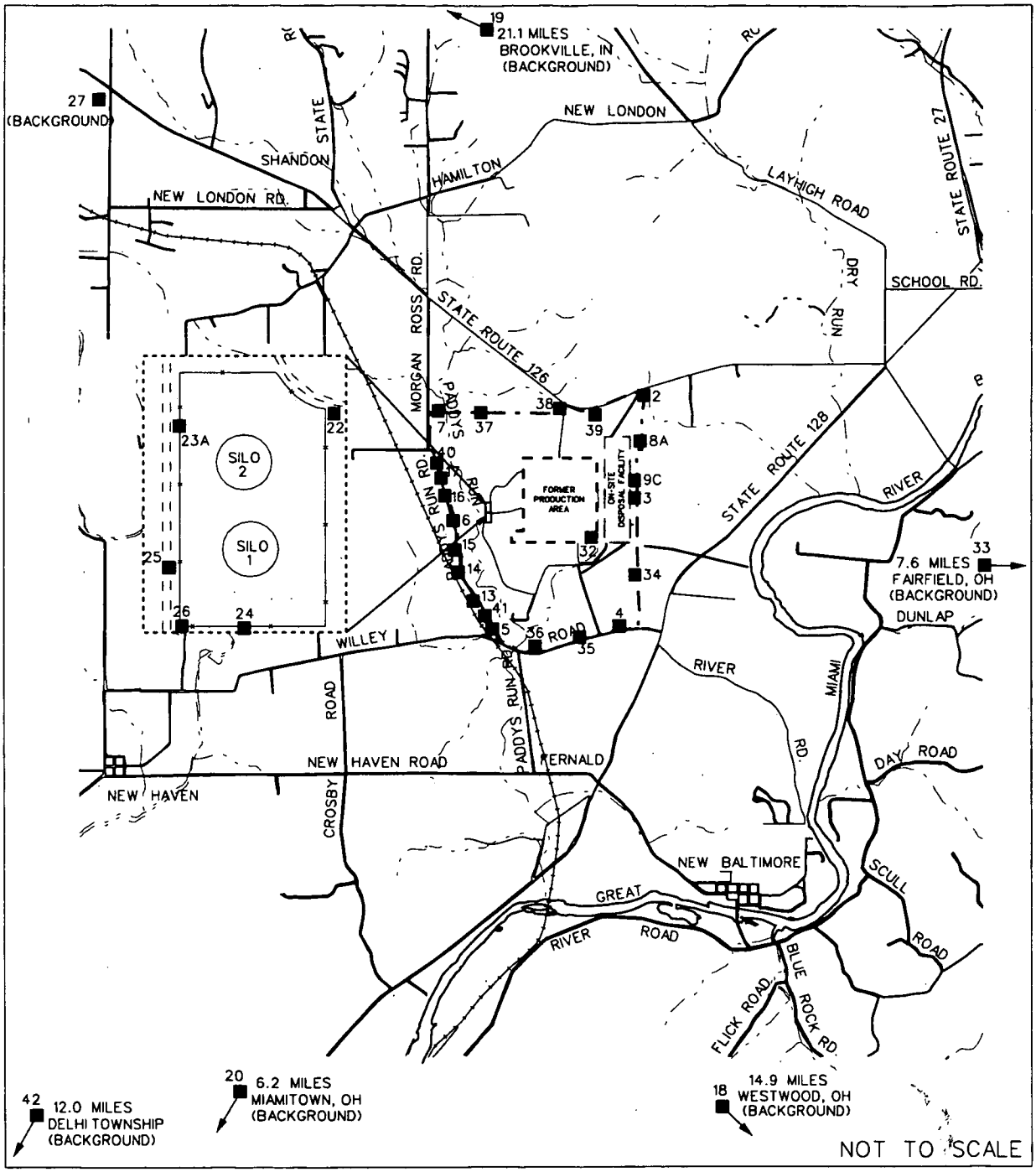


Note: 1) Defective sample line for Silo 1 was replaced during fourth quarter 1996.
2) Silo headspace correction was applied beginning with the first quarter of 2000.

Pre-Bentonite Levels:
Silo 1 ~ 26,000,000 pCi/L
Silo 2 ~ 30,000,000 pCi/L

FIGURE 4-27. QUARTERLY K-65 SILO HEADSPACE RADON CONCENTRATIONS, 1992 - 2000

FINAL



LEGEND:

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO SAMPLE LOCATIONS OFF MAP

FEMP BOUNDARY

DIRECT RADIATION (TLD) MONITORING LOCATION

FINAL

000136

FIGURE 4-28. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MONITORING LOCATIONS

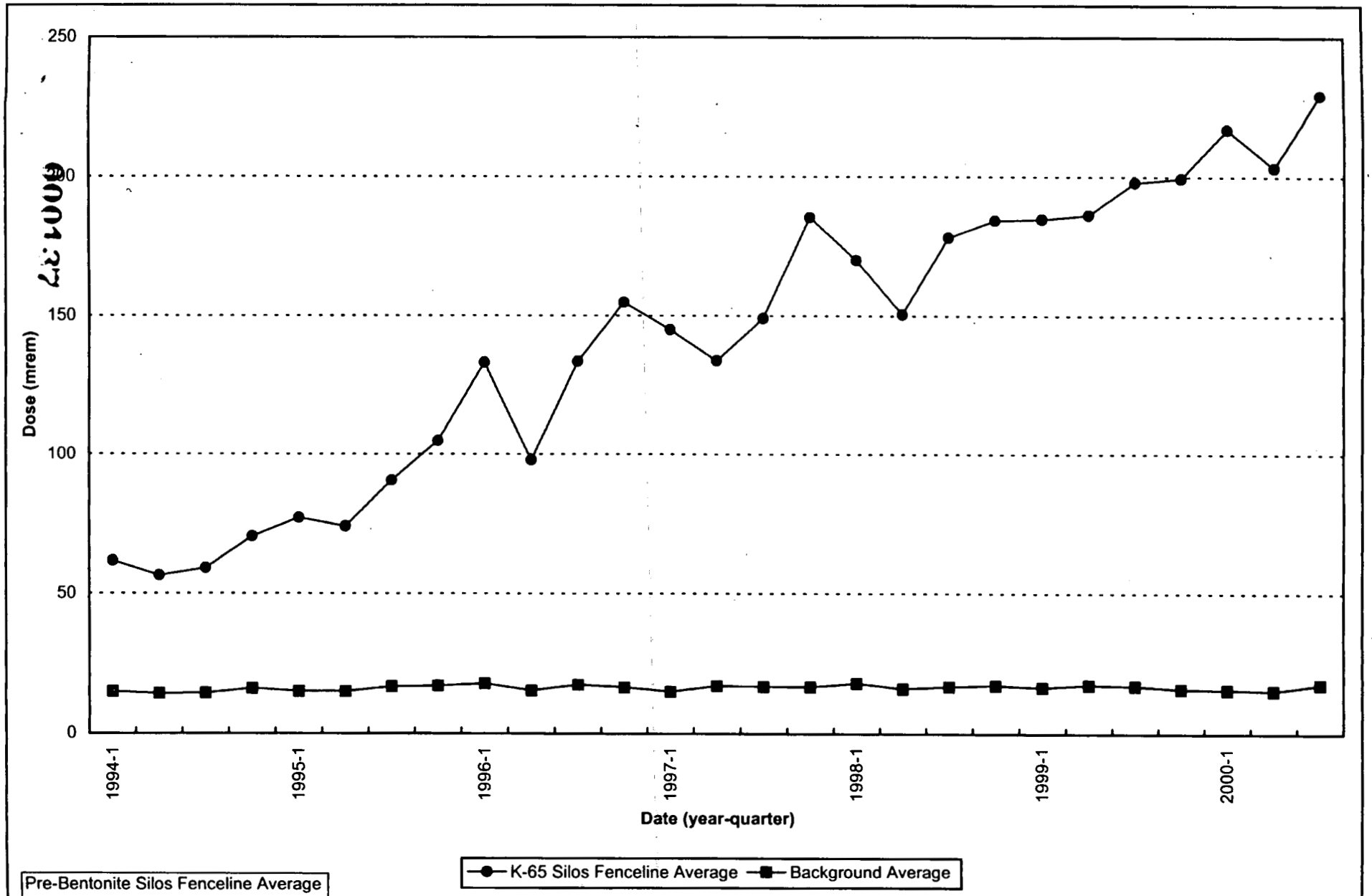


FIGURE 4-29. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 2000
(K-65 SILOS FENCELINE AVERAGE VERSUS BACKGROUND AVERAGE)

FINAL

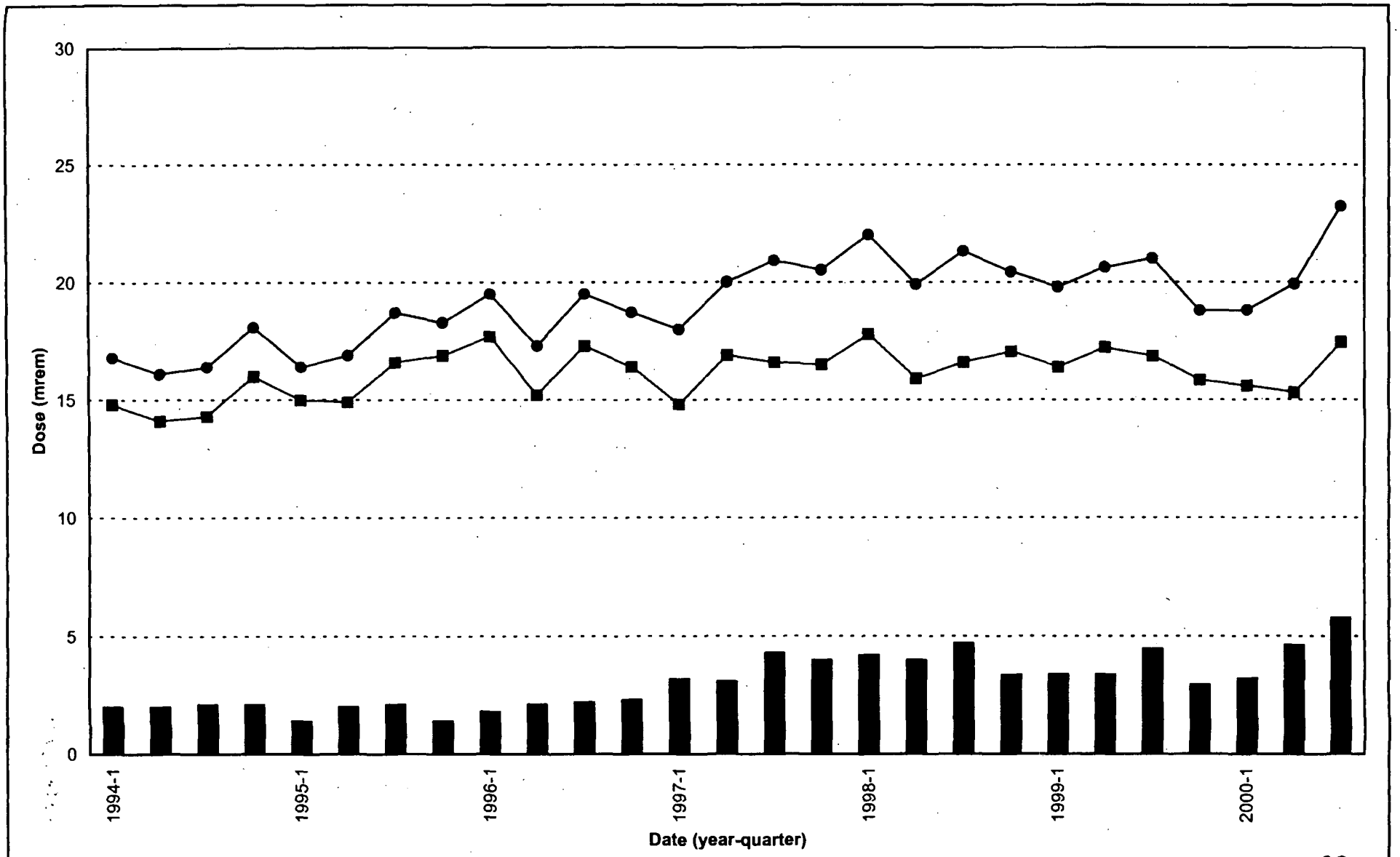


FIGURE 4-30. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 2000
(LOCATION 6 VERSUS BACKGROUND AVERAGE)

FINAL

Natural Resources

5.0 NATURAL RESOURCES

This section provides a summary of newly impacted or ecologically restored areas, as well as the monitoring of wetlands and endangered species at the Fernald site.

Several habitat impacts took place during the third quarter of 2000. First, approximately three acres of riparian woods and mowed grass were excavated in the Area 2, Phase I "Carolina Area" in order to remove contaminated debris in the vicinity of the southern waste units. Habitat impacts from this activity were minimized by maintaining the existing overstory trees to the greatest extent possible, and by transplanting a number of great blue lobelia (*Lobelia siphilitica*) to Area 8, Phase II prior to soil disturbance. Also, approximately two acres of an early to mid-successional woodlot in the vicinity of the Pilot Plant Drainage Ditch were impacted during the installation of several wells as part of the aquifer pumping test for the Pilot Plant Drainage Ditch plume area. These impacts were also minimized by avoiding removal of the existing overstory trees. Finally, one row of Austrian pines (*Pinus nigra*) was cleared along the southern edge of the northern pine plantation for construction of the access road to the on-site disposal facility laydown area. Because the majority of the non-native Austrian pines will be cleared as part of the ecological restoration of the northern pine plantation, this clearing is not considered to be a major habitat impact.

During the third quarter of 2000, ecological restoration work involved only maintenance activities. The maintenance activities included the installation of approximately 2,300 protective tubes on all planted trees in the following restored areas: Area 1, Phase I; Area 8, Phase I; and Area 8, Phase II. These tubes will minimize damage from deer rubs during the fall rut season.

Several natural resource-related monitoring activities also took place during the third quarter of 2000. The Area 1, Phase I wetland mitigation monitoring continued pursuant to the design plan. Also, routine monitoring by university researchers continued at each of the five ecological restoration research projects.

3401

Meteorological

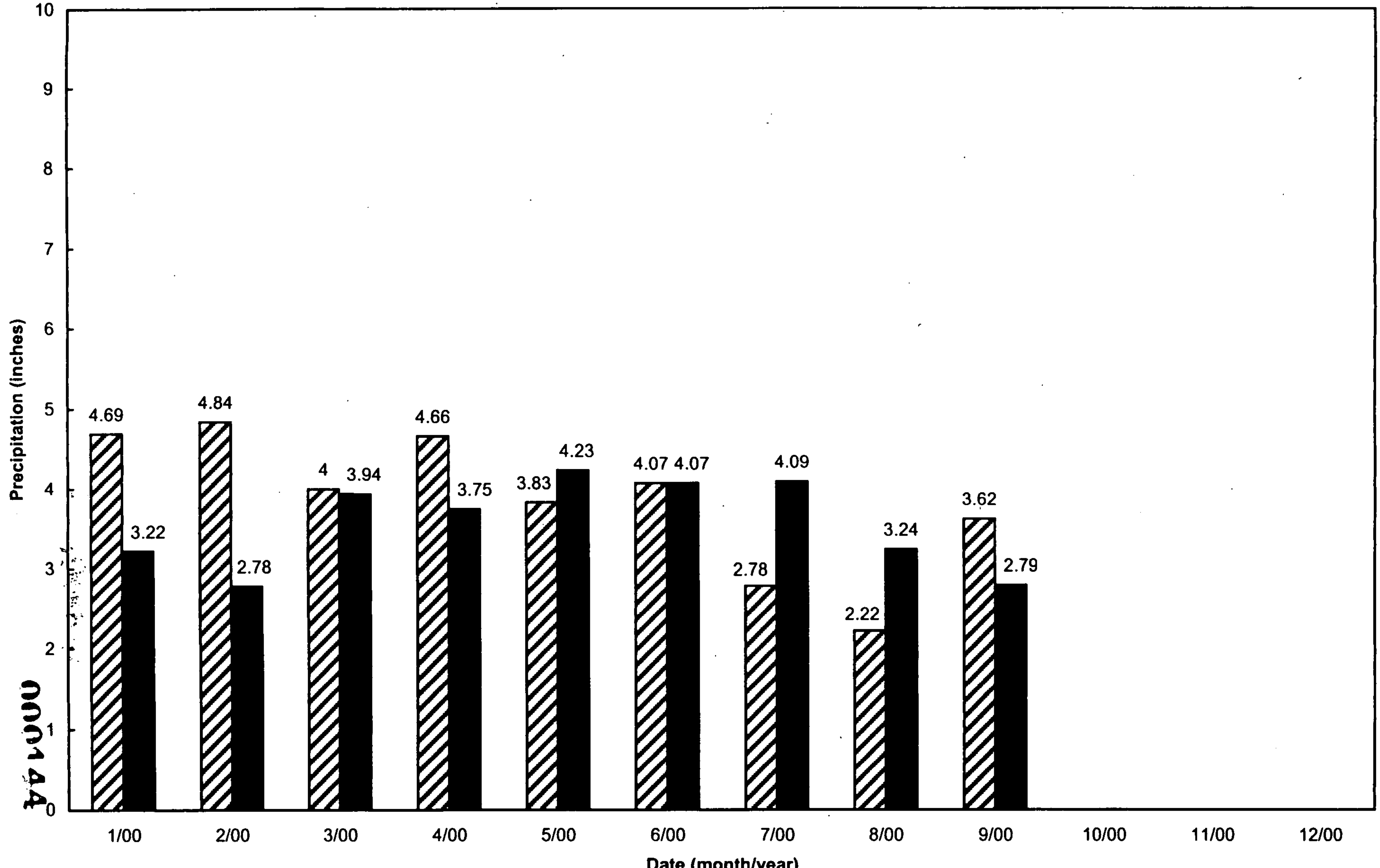
000141

6.1 MONTHLY PRECIPITATION

This section provides the third quarter 2000 monitoring activities for the Integrated Environmental Monitoring Plan (IEMP) meteorological monitoring program. Figure 6-1 shows 2000 precipitation by month in the Fernald area compared to average precipitation by month from 1949 through 1998, based on data collected at the Greater Cincinnati/Northern Kentucky International Airport and at the Fernald site. Precipitation during the third quarter of 2000 was 8.62 inches, slightly lower than the average 10.12 inches for this time period.

6.2 WIND ROSE

This section provides the third quarter 2000 monitoring activities for the IEMP meteorological monitoring program. The third quarter 2000 wind rose (Figure 6-2) indicates that the predominant wind directions were from the southwest quadrant. The wind rose indicates that airborne emissions from site remediation activities would be carried towards air monitors along the northern and northeastern fenceline of the site. The third quarter wind rose is consistent with historical annual wind rose data for the Fernald area, which indicates that the predominant wind directions are from the southwest, which includes the south-southwest, southwest, and west-southwest sectors.

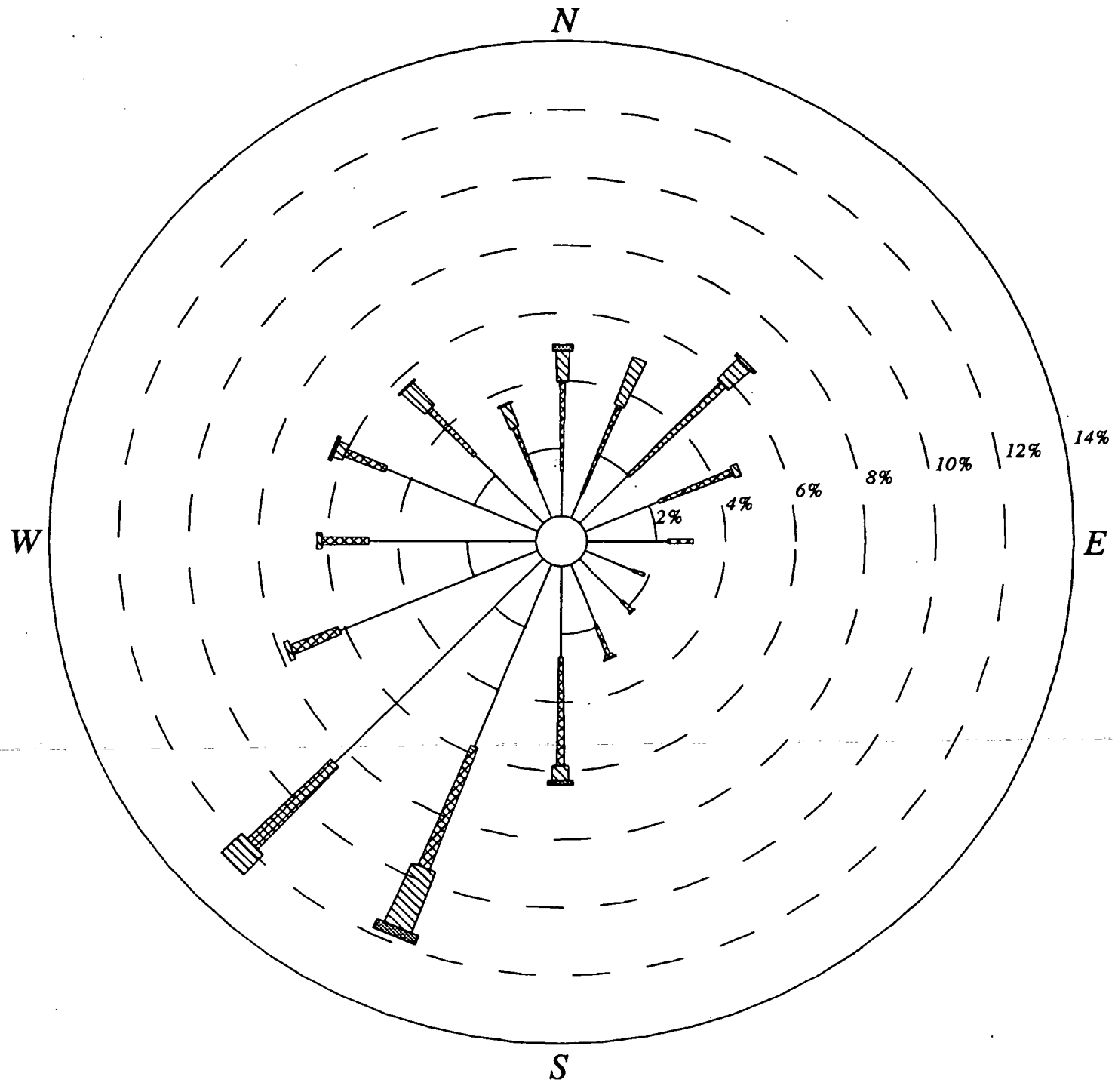


1999 FEMP Precipitation Total: 34.39 inches
Average Precipitation Total (1949 - 1998): 41.20 inches [a]

[a] Precipitation averages prior to 1993 are from the Greater Cincinnati/Northern Kentucky International Airport and averages after 1993 are from the FEMP.

FIGURE 6-1. 2000 FEMP MONTHLY PRECIPITATION DATA

FINAL



CALM WINDS 7.51%

WIND SPEED (KNOTS)

NOTE: Frequencies indicate direction from which the wind is blowing.

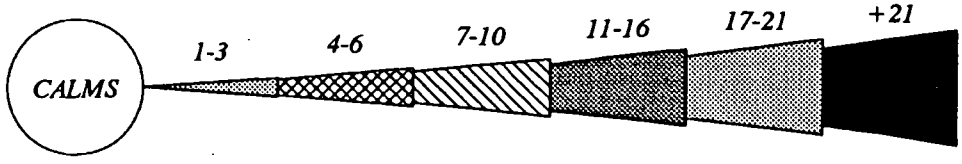


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FIGURE 6-2. THIRD QUARTER 2000 WIND ROSE DATA, 10 METER HEIGHT

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